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ABSTRACT

The course in Applied Number is designed to be covered with the course in Pure Number (see SE 012 723 to 725). The aims of this course are stated to be: "the development of (1) comparison: as exemplified by measurement; (2) exploration of the environment; (3) skills: among these, estimation and computation; and (4) language: as a medium for accurate description." This development takes place through continuous experiences with concrete materials, participation in planned activities, and opportunities for individual discovery. Each section of the guide contains notes on content and method, and suggested materials, equipment and activities relevant to six concept areas: length, volume and capacity, weight, time, money, and spatial relations. Under the first three headings, Section A develops the idea of comparison; Section B discusses the idea of a unit, using informal units; and Section C introduces the standard units foot, pint and pound. Concepts of time are developed more slowly, and money activities relate mainly to an appreciation of buying and selling. The sections concerned with spatial relations develop awareness of space through recognition and naming of common shapes, classification, and creative construction. The growth of vocabulary is stressed throughout the guide. (MM)

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CURRICULUM GUIDE

ARITHMETIC

SECTION I

CURRICULUM GUIDE

APPLIED NUMBER COURSE

SECTIONS A, B, C

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GENERAL INTRODUCTION

The Curriculum Guide for Applied Number, Sections A–F, is presented in two parts, one covering Sections A, B, C of the course and the other, Sections D, E, F.

Aims

The aims of the course are set out in the Course of Study in Mathematics 1967, and throughout the Guide, but in broad outline, these aims may be stated as the development of :

(i) comparison : as exemplified by measurement ;
(ii) exploration of the environment ;
(iii) skills : among these, estimation and computation ;
(iv) language : as a medium for accurate description.

This development takes place through continuous and challenging experiences with concrete materials, participation in planned activities, and opportunities for individual discovery.

Comparison and Exploration

In the early sections of the course the child learns to compare attributes, such as length, weight, colour, shape, and size, to discover both similarities and differences. Later, he learns to measure the attributes of length, weight, and capacity, using informal units so that he can express these attributes more precisely. From these activities he becomes aware of the need for common and, later, standard units of measurement. He also comes to appreciate the need for greater precision in measurement. In all these activities, mathematics becomes an important tool for exploring the child's world in a quantitative manner. Similar needs arise in the topics of time and money as the child begins to develop ideas of duration and equivalent value. In the field of spatial relations the child develops an increasing ability to describe the objects in his environment in terms of shape and location, and explores his world in a non-quantitative manner.

Skills

As will be seen from the notes that follow, a continuing emphasis is placed upon skills such as the manipulation of materials and equipment, the developing ability to estimate, and, later in the course, to compute. In the past, great emphasis was placed upon computational skill. The attainment of such skill remains an important part of the present course which, however, demands that prerequisite understandings be attained before formal computation begins in Section G.

Language

The development of the child's ability to communicate with increasing precision is an integral part of the course. Vocabulary should arise from the child's need to express himself meaningfully, using terms which he understands to describe what he sees, what he has done, and the conclusions he has reached. The use of technical language is justified only when it serves to clarify, rather than to inhibit, understanding. The language used by the child becomes an important tool to assist the teacher to assess the child's learning and understanding.

The Use of Materials

Reference to the Guide will show that the course is one in which the child constantly works with materials and equipment rather than passively accepts instruction. It is the use of these that assists the child to discover relationships and to gain experience. The materials mentioned in the Guide are by no means prescriptive, and teachers should avail themselves of every opportunity to add to those listed, particularly from the local area.

Activities

In the early sections of the course the child, through free play, discovers many of the properties of the materials at his disposal ; but after this initial period his activities become directed towards a particular goal. The same pattern should be followed whenever new materials or ideas are introduced at any level. Increased maturity and confidence will allow him to make use of his own initiative to solve problems, investigate relationships, and describe the environment in which he lives.

The Role of the Teacher

The provision of materials and equipment and appropriate situations for their use is an important part of the teacher's task. However, it is vital that through discussion the teacher should guide the child so that he may obtain the greatest value from his discoveries and his experiences. The child should be encouraged to appreciate that problems may be solved in a variety of ways and, later, he should be encouraged to initiate his own investigations.

The Role of the Guide

Each teacher has the responsibility of interpreting and presenting the course to her own class. This Guide has been prepared to assist in this. It is hoped that teachers will not limit themselves to the material of the Guide, but, as alternative worth-while approaches are suggested from other sources, that they will feel free to incorporate them.

SECTION A

INTRODUCTION

Aims

The major aims of this section are :

(i) To develop, through free and directed use of materials, the ability to match and compare quantities and shapes.

(ii) To develop a meaningful use of vocabulary related to quantity, size, shape, and position in order to express ideas gained through experience.

Similarities and Differences

The expression " match and compare " as used in Aim (i) above implies that the child will look for both similarities and differences. However, these two aspects go hand in hand, and it is only after comparison has been made that matching is possible, that is, that similarities or equalities can be established.

Sight and touch are most frequently used in developing ideas of comparison :

Sight—" The clouds are grey today, but yesterday they were white."

Touch—" This piece of wood is rough and that piece of paper is smooth."

Teachers should provide opportunities for the other senses to be employed in order to enrich experiences of comparison as well as vocabulary :

Hearing—"A whisper is quiet ; a shout is loud."

Taste—" The lemon is sour, but the sugar is sweet."

Smell—" My medicine smells like orange juice."

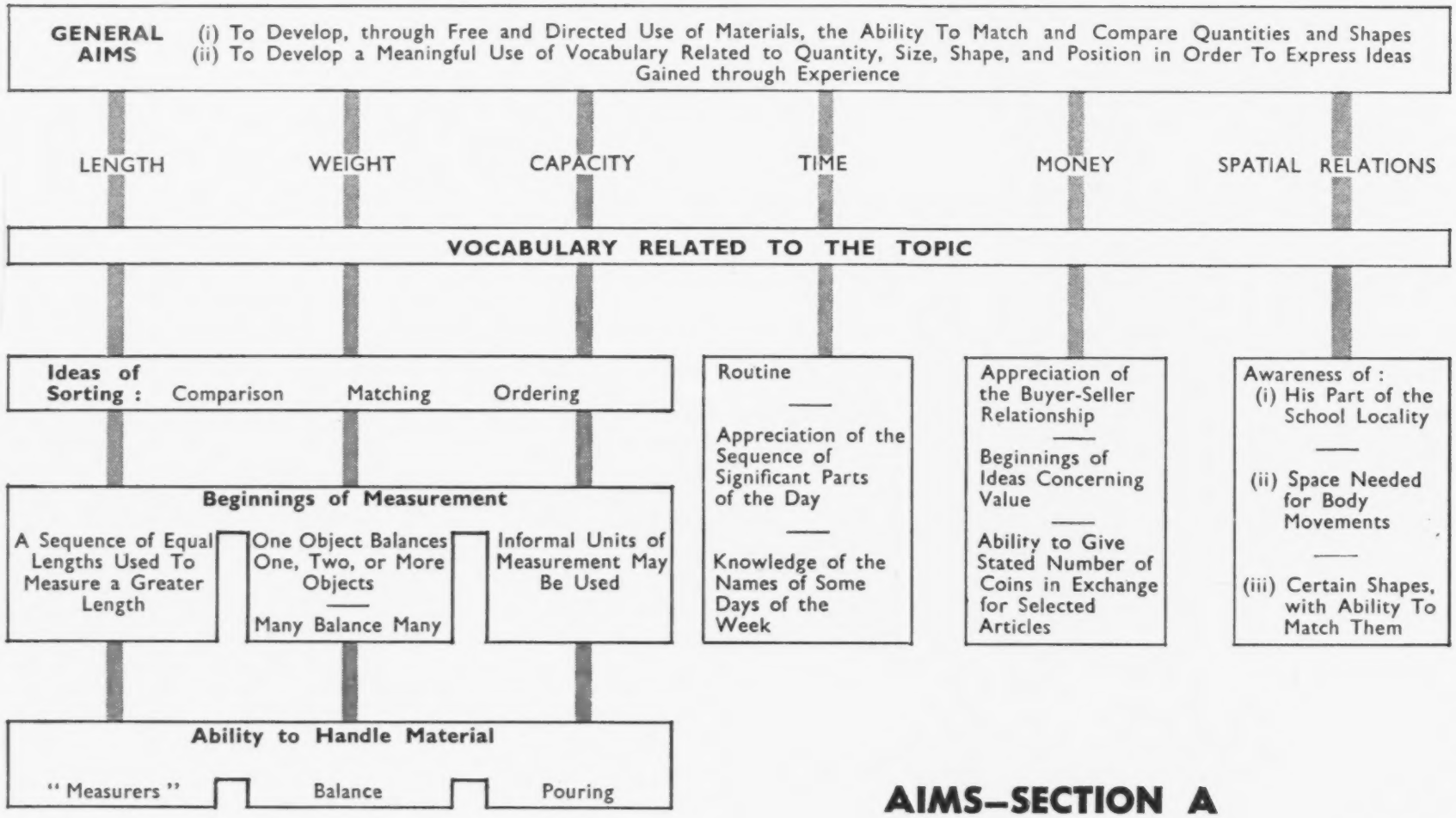
It is important to realize that certain comparisons may be made simply by sight alone, while others require additional approaches :

Length—Sight alone is sufficient, particularly if the differences are great and the lengths to be compared lie next to each other.

Weight—This cannot be judged by sight alone ; judgment must at least be based on physical reaction, or pull on muscles, when the objects are picked up.

Capacity—Sight may not be enough, the shape of the container could be deceptive ; when this is so, comparison is only possible if a formal or an informal unit is used to measure.

The implementation of these ideas is further discussed in the developmental stages outlined on pages 12 to 15.


GENERAL AIMS
(i) To Develop, through Free and Directed Use of Materials, the Ability To Match and Compare Quantities and Shapes
(ii) To Develop a Meaningful Use of Vocabulary Related to Quantity, Size, Shape, and Position in Order To Express Ideas Gained through Experience
LENGTH
WEIGHT
CAPACITY
TIME
MONEY
SPATIAL RELATIONS
VOCABULARY RELATED TO THE TOPIC
Ideas of Sorting : Comparison Matching Ordering
Beginnings of Measurement
A Sequence of Equal Lengths Used To Measure a Greater Length
One Object Balances One, Two, or More Objects
Many Balance Many
Informal Units of Measurement May Be Used
Ability to Handle Material
" Measurers "
Balance
Pouring
Routine
Appreciation of the Sequence of Significant Parts of the Day
Knowledge of the Names of Some Days of the Week
Appreciation of the Buyer-Seller Relationship
Beginnings of Ideas Concerning Value
Ability to Give Stated Number of Coins in Exchange for Selected Articles
Awareness of :
(i) His Part of the School Locality
(ii) Space Needed for Body Movements
(iii) Certain Shapes, with Ability To Match Them

AIMS—SECTION A

The Development of Language

It is fundamental to mathematics that ideas be expressed with precision, and in Section A the child begins to build a vocabulary which will allow him to express himself accurately and fluently within the bounds of his understanding.

Children may often have understanding and yet lack the means of expressing this because of language difficulty :

A child may use " big " when he means " long ", " heavy ", or " high " ;

he may understand a word when others use it and demonstrate this by making a *long* train or a *high* tower when directed.

Many opportunities for vocabulary development arise incidentally and the teacher will use these as they occur—

in dramatic play : " Mary is wearing a *long* dress and Helen has a *short* coat."

at library time : " Billy's book is *big* but mine is *small*."

during art : " I can draw a *thick* line with my paint brush."

Concurrent with this incidental teaching go planned activities aimed at introducing specific words so that the child's understanding may be extended and his vocabulary increased.

When observing the child and listening to him the teacher will :

(i) determine the child's understood vocabulary ;

(ii) widen this vocabulary by using specific words incidentally ;

(iii) assess the extent of the vocabulary used in conversation.

All of this must be done in a friendly and relaxed atmosphere which allows the child to talk freely with both his teacher and his peers. He can discuss his experiences, show where his difficulties lie, and demonstrate or use what he has learned.

Free Play and Directed Activities

During free play the child discovers many of the properties of the materials he uses :

Dry sand will flow and damp sand will hold certain shapes ;

some blocks will fit together to make a stable structure, while others will not ;

a small rock can be heavier than a larger piece of plastic foam.

With many activities it is difficult to state the duration of the free play necessary before direction begins. The time will be determined, at least in part, by certain factors, such as the child's interest in the activities or the development of certain skills :

To pour water without spilling ;

to handle and fit blocks together ;

to add material to, or remove it from, a balance.

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The teacher must watch progress closely since it is necessary to give the child tasks to perform which—

lie within the range of his skill ;

provide him with the necessary stimulus to increase his understanding.

Guidance may be needed to help the development of some skills :

A group of children engaged in water play could regard a bottle as full when this is not so ;

the teacher may feel that group work on filling and emptying containers is desirable so that ideas of " full " and " empty " are consolidated.

From this free play the child will move on to directed activities. These are, in the main, activities where the child is asked to make comparisons. The child may be asked to—

find a stick longer than his table ;

choose a block heavier than his book.

These are " one-to-one " comparisons and the idea of units does not need to be considered.

Vocabulary work will also be part of the directed activities :

Make a *wide* road.

Make a *small* paddock ; now make a *large* one.

After much experience at this level the child moves to the final stage of Section A, generally referred to as " assignment work ". Here he is able to understand the concept of measurement involving units. Now, if he is asked to find how long his table is, he may choose informal units of his own and decide the length to be one block, two sticks, and a book ; or two blocks and five sticks.

From this he begins to express himself in terms of one unit—his table is ten sticks or eight blocks long.

The main lines of development may be summarized :

1. Play
2. Compare
3. Match
4. Order
5. Measure

and these are, to a large degree, sequential. However, it must be borne in mind that the child who has reached the stage of comparing weights may still be playing with respect to his work on capacity and could be ordering with respect to length.

Vocabulary Books

Vocabulary is best developed as a meaningful way of describing experience that has been gained by the use of concrete aids and classroom situations. It can be extended by the use of pictures and illustrated books featuring certain of the concepts at preparatory level.

Children may construct books of this type for themselves :

Pictures cut from magazines may be pasted on paper, or illustrations may be drawn by the children ;

the appropriate vocabulary words are added ;

the sheets are combined to make a book.

Terms that may be illustrated are : Big, little ; long, short ; thick, thin ; full, empty ; high, low ; and many others.

Care should be taken to ensure that the illustrations show only the feature under discussion ; confusion can arise when extraneous material and detailed background are added. Illustrations can provide a focal point for pupil-teacher discussion, while the child's own drawing will serve to show this understanding. Both of these aspects are important for the teacher when assessing the child's progress.

The Role of the Teacher

Many factors, among them the differences in social background, pre-school experience, and the structure of the family, contribute to the wide range of individual differences found in the preparatory grade. The course, implemented by the teacher, will allow the building up and the widening of the child's experiences and vocabulary.

The teacher must—

(i) discover the nature and the extent of pre-school experiences in relation to the ability both to handle materials and to use language ;

(ii) provide equipment and opportunities to extend these experiences ;

(iii) observe the child in order to—
judge the child's stage of development ;
decide when to add to the child's experience.

A knowledge of the child's background is the teacher's guide to planning the course and the activities associated with it, so that the child develops the understanding needed for progress.

The teacher needs to appreciate that—

the child's world of measurement is largely one of comparison : Dad is taller than he is, and he is taller than his sister ;

the child is often confused in his terms because of his environment : He is a big boy at home but a little boy at school.

A child has a natural inclination to sort and arrange things, and as he progresses through the preparatory grade the teacher must help him to appreciate comparisons better and to gain an understanding of ordering. For example, when working with length the child—

places in groups the long and the short ;

uses sticks of the same length to build a fence ;

finds different objects of the same length : a slipper and a block, a pencil and a book ;

gains the concept of ordering from the shortest to the longest.

The teacher is able to place the child in a situation where there are opportunities to learn ; but she must also influence the child so that he will develop an interest and a desire to achieve this learning. Once this interest has developed, the teacher evaluates progress through observation and conversation, and from this decides when the child should be presented with more difficult tasks.

In the section that follows, a developmental approach has been planned. The work in the topics of length, weight, and capacity should effectively fit into this plan and so provide the teacher with a solid basis for the course as a whole.

STAGES IN THE DEVELOPMENT OF A TOPIC

Stage I—Free Play and Directed Activities

Free Play

Here the child is gaining experience for himself and by himself.

He should—

(*a*) discover properties of materials :
That dough or clay can be shaped or moulded ;
that certain shapes fit together ;
that wood can be harder than plastic foam.

(*b*) develop a vocabulary :
A roll of clay may be *short* and *thick* or *long* and *thin* ;
a " road " which he has made can be *wide* or *narrow*.

Directed Activities

The child's activities are now directed along certain lines so that he does something specific.

He can be given directions which may—

(*a*) define a goal clearly :
" Make a tower as high as the table."

(*b*) include a problem to be solved :
" Here is a short train. You make a long one."

Vocabulary is developed so that the child can—

(*a*) describe what has been achieved :
" I have made a long train."

(*b*) use comparative terms :
" My train is longer than Ian's."

(*c*) use more precise descriptive terms :
" My train is six blocks long."

Note that all these examples are related to work on length but that similar examples based on work on weight and capacity could be used.

Oral Assignment Work

This forms the most refined stage of directed experience in Section A. Because of reading difficulty the instructions must be given orally,

and in many cases results cannot be written. It is in discussing results that the teacher can assess the level of the child's understanding :

Children are asked to make a long train using blocks.

Child A uses ten blocks for his train and Child B uses only three blocks.

Discussion reveals that Child A knows he has made a long train because he " used a lot of blocks ".

Child B considers his a long train because " it's longer than this train ", indicating a single block.

Both children understand the idea of length and have demonstrated this, yet at a cursory glance, without discussion, an observer might think that Child A had a better understanding than Child B.

Examples of this type of assignment work are shown in the activities pages for each topic. In many cases it will be noted that some form of measuring in terms of numbers of units is asked for.

Stage 2—Development of Comparison

(*a*) *Sorting*

(i) Two sets of objects with respect to one particular attribute.

These attributes may include weight, length, texture, colour, shape, size, capacity, etc.

Examples :

Beads to be sorted according to colour.

Blocks of wood to be sorted into a " heavy " set and a " light " set.

(ii) Three lots of objects, then more than three.

This is an extension of (i), using larger numbers of objects, but one specific attribute is still the basis for sorting. Such exercises must be within the child's level of understanding.

Example :

Circles, triangles, and stars to be sorted by shape.

Large, small, and middle-sized containers to be sorted according to capacity.

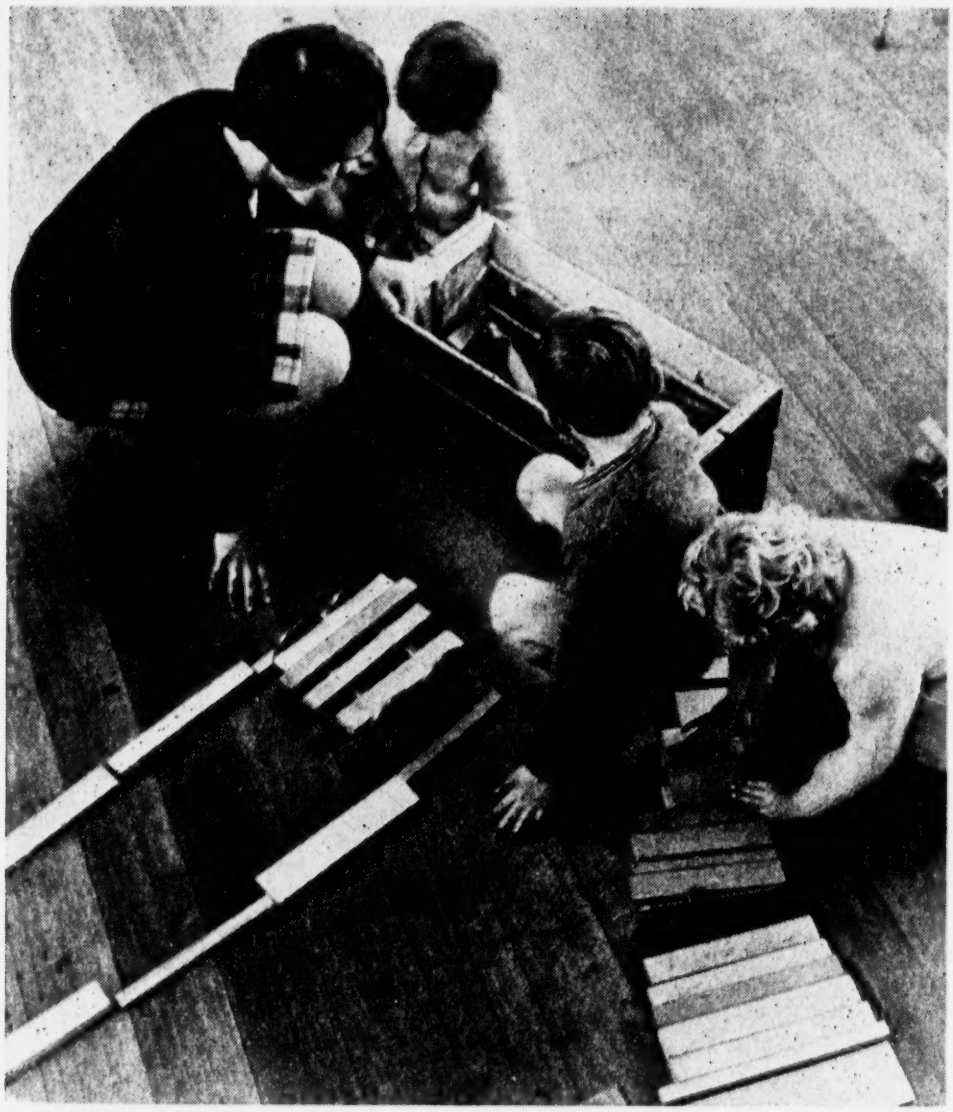
(iii) More than two collections, with respect to more than one attribute.

Example :

A box of coloured sticks to be sorted according to length and colour into—

the long blue sticks,
the short blue sticks,
the long red sticks,
the short red sticks.

Note that this may also be considered as a variation of (i) in that it is a two-stage activity, the child sorting first on the basis of size (the long sticks and the short sticks) and then on the basis of colour (the blue sticks and the red sticks).



(*b*) *Ordering*

Here the child is asked to compare differing degrees of the one attribute. He is asked to compare two objects, then three, and then, perhaps, four or more.

It is suggested that three objects should be the maximum for capacity and weight, but it should also be borne in mind that the child will be asked, later in the year, to order ten objects with respect to length if he works with the Cuisenaire material.

Examples of this type of work are :

Place these sticks in order, starting with the longest and finishing with the shortest.

Put the nesting cubes in line, the smallest one first and the largest one last.

Here are seven nesting cups. Fit them together, one inside the other.

Very few children solve the problem of size order quickly. Most children need much experience before being presented with a more difficult task.

Although sorting implies the awareness of both similarities and differences, the child should be led to the realization that equivalence

can exist with respect to one, some, or all of the characteristics :

Two packages may be the same in size and shape, but may differ with respect to weight and colour.

Discussion along these lines provides valuable experience with vocabulary work.

Stage 3—Comparison Defined in Terms of Measurement

(*a*) *Comparison of Equals*

Examples :

Find a stick as long as your table.

Choose the block as heavy as this box.

This work could be introduced by comparisons involving inequality :

Find a block that is longer than this box.

Choose the tin that holds more water than this bottle.

(*b*) *Comparison Involving Multiple Units*

In the early work unlike " units " will be chosen :

A block will be found to balance two bolts, an acorn, and two nails ;

a ribbon will be equal in length to two sticks and a block.

Later work will direct or suggest to the child that similar units be used :

How many matchboxes long is the doll's table ?

How many cupfuls of water will fill this bottle ?

In exercises involving length, the child, at this stage, may place the appropriate number of units in position and count them. Some children may progress beyond this and move their " measurer " along the length to be measured.

★ ★ ★

In Section B the child will be encouraged to see the need to choose appropriate units as he works :

To fill a bucket using a jug ;

to fill a jug using a cup ;

to fill a cup using a spoon.

This is a difficult idea and some children may not develop it until a later section. However, if opportunity arises in Section A, the teacher should treat the idea incidentally with those children who can appreciate it.

Important attitudes towards the setting out and the putting away of material and equipment, the ideas of sharing and of working together, the discussion of results, and mutual assistance can all be fostered in Section A. These will form the foundation for future work and habits in the subject of mathematics, as well as in the other subjects of the curriculum.

SECTION A--LENGTH

NOTES

Refer also to Stages in the Development of a Topic, pages 12 to 15.

Building and Playing

Building-blocks provide the children with opportunities to appreciate that the size of the block is important in—

adding lengths (horizontally) or heights (vertically) ;

bridging a gap.

In construction work, the child begins to estimate the number of pieces he must join to make a model of a certain size :

Make a train you can sit in.

Make a bridge to go over your road.

Both of these aspects may be regarded as " selection for a purpose " and involve comparison and estimation.

Comparison and Ordering

This topic may be readily developed along the lines suggested in the introduction to Section A and in the topic development outline. Comparison is the basis for sorting or for classification. Ordering involves the comparison of degrees of a specific attribute, in this case, length.

Much work is needed to establish a concept of ordering. Only two sets should first be used : long and short ; big and little ; thick and thin. The number of sets can then be extended to three, and again much work is required. Extension beyond this is possible only after these introductory stages have been established soundly.

Vocabulary

The importance of vocabulary has been discussed in the introduction. The teacher should be aware of the child's " working vocabulary " as he talks to his peers, and often it is possible to assess his degree of understanding in this way.

Definition is not to be attempted at this stage although foundations for this will be laid as the child participates in many of the activities.

One aspect of the vocabulary of length which may occur is the distinction between length and width. For some children this is intuitive, the longer axis being accepted as the length and the shorter axis as the width. The ideas of length, width, height, breadth, and depth will be consolidated in Section A and later sections through usage and the experience gained in the planned activities.

Vocabulary Books

The compilation of vocabulary books is discussed on pages 10 and 11, and it is important that they be part of the activity work related to length.

Outcomes

By the end of Section A the child should have—

(*a*) a vocabulary which is related to length and which can be used with understanding ;

(*b*) an idea of comparison and equality ;

(*c*) an idea of sorting and ordering materials with respect to length ;

(*d*) the beginning, at least, of an awareness that a series of lengths may be used for comparison with a continuous length.

SUGGESTED ACTIVITIES

Notes

(i) These activities are suggestions only and are not presented in any sequence of development.

(ii) Many of the activities can be adapted to provide easier or more difficult activities. Similarly, one such activity may become the core of a series of graded activities.

(iii) Teachers should watch each child to ensure that the activity lies within the range of his understanding and ability.

(iv) The wording used in these suggestions need not be used in presenting them to the child ; teachers will adapt the vocabulary to the child's level.

(v) Instructions will be given orally. Because of the child's inability to record his results formally, provision will have to be made for the results to remain in position until the teacher can come and discuss the activity with the child.

Activities

Measure with sticks—

the length of your table ;
the length of a straw.

Are they the same length ?
Which is the longer ?
Which is the shorter ?

★

Cut a piece of string as long as—

your reader ;
your chalkboard ;
the back of your chair.

★

Cut a streamer to be the same length as—

2 matchboxes end to end ;
4 matchboxes end to end ;
6 matchboxes end to end ;
1 matchbox ;
5 matchboxes end to end ;
3 matchboxes end to end.

Paste the pieces of streamer on to a piece of card.

★

Build a wall four blocks high.

★

Build a road eight sticks long and two sticks wide.

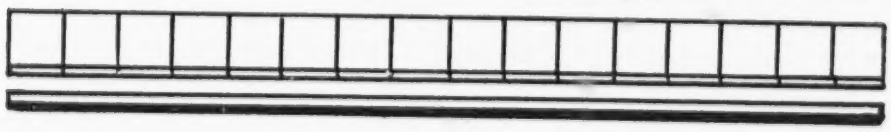
★

Make railway lines twenty matchboxes long.
Put a bridge two blocks high at the end.

★

Provide the child with assorted materials, e.g. plastic piping, ribbon, sticks, cord, twine.

Ask the child to order these things from the shortest to the longest ; then to measure each, using plastic counters.



★

Using clay, make a snake. Break off a piece as long as a cotton-reel.

★

Put a stick, a piece of chalk, and a pencil end to end. Measure the length, using sticks of chalk.

★

Take a long piece and a short piece of plastic string. Find how many beads fit on each.

★

How many matchboxes are as long as—

three sticks end to end ?
four pencils end to end ?
six pieces of chalk end to end ?

★

Provide a variety of sticks and other linear material for the child's table.

Ask the child to measure everything on the table with a streamer, cutting the streamer as he does so.

★

Put five icy-pole sticks end to end.

How many matchboxes make the same length ?

How many pencils make the same length ?

How many bolts make the same length ?

★

Provide strips of different fabrics of varying lengths.

Ask the child to—

(i) sort the strips into pairs of equal lengths ;

(ii) measure the pairs, using a length of cord.

MATERIALS AND EQUIPMENT

Sticks : A variety of lengths, shapes, and colours, e.g.—

sets of graded lengths, 1 inch to 1 foot, unmarked ;

sets in related lengths, up to 4 feet ;

sets of equal lengths, unmarked, some 1 foot long ;

sets of plastic sticks, various lengths and colours ;

curved sticks, for example, lengths of wood from the curved backs of old chairs ;

sticks of a variety of cross-section.

Height Charts : Hung from the wall to measure children's heights.

Graded Material : For ordering :

Buttons, shells, pebbles, lengths of card, corks, cans, nesting blocks and cups, lids, and bottle tops of assorted sizes.

Shapes in a variety of sizes.

Linear Material : Varied lengths of string, rope, cord, wool, ribbon, plastic lacing, and plastic tubing.

Construction Sets : Where a variety of lengths may be fitted together by slotting or by using screws, nuts and bolts, clips, and so on. Care should be taken to select material that is large enough to allow easy manipulation.

Blocks : A wide variety of shapes and sizes to encourage the children to build both long models and tall models.

SECTION A—VOLUME AND CAPACITY

NOTES

Refer also to Stages in the Development of a Topic, pages 12 to 15.

Vocabulary

Language work will stem from the child's desire to describe and discuss his activities. The teacher must ensure that the child uses correct vocabulary and understands this when it is used by others. Once this has been established, then it is possible to extend and refine the vocabulary and to present the child with ideas to vary the language he uses :

"I can fill your cup from my bottle of water."

"You can empty your cupful of water into my bucket."

"My bottle of water will fill three of your tins."

The child's use of this vocabulary in everyday conversation with his peers can provide a guide for the teacher when making her assessment of the child's progress.

Play

During the free play stage the child may, from time to time, be directed so that the teacher is able to lead him to work more efficiently to develop skill or to widen his concept of capacity. However, most of the play is undirected.

Care should be taken to see that situations arise or are created to enable the child to experience the fundamental ideas of the section in which he is working, and often it is possible to provide activities that will lay foundations for future work. For example, in Section B the child will discover certain relationships about the combining and the dividing of material. In Section A he will come to see certain aspects of this topic :

That a bottle of water will fill a jar, a cup, and a tin ;

that a ball of clay can be used to make a number of different models.

Here his experience will begin in Section A, but his realization and discussion of the principle underlying what he is able to do may not come until Section B or even Section C.

Vocabulary Books

Vocabulary books are discussed in the introduction to Section A (see pages 10 and 11) and teachers should refer back to this so that the books may be used with respect to capacity also.

Outcomes

By the end of Section A the child should—

(*a*) have an understanding of the vocabulary related to capacity ;

(*b*) be able to pour liquids without spilling and to handle material economically ;

(*c*) estimate, order, and compare capacity to some degree when containers of simple shapes are used ;

(*d*) have some ideas about the informal measurement of capacity.

SUGGESTED ACTIVITIES

Refer also to the notes on the suggested activities for length, page 17.

Supply a quantity of sand and containers such as : Bottle and cup ; jar and bowl ; jug and mug.

The child is asked to determine—

which container holds more (for each pair) ;

which container holds the lesser quantity ; or

whether they hold the same quantity.

★

Provide a beach bucket, some bowls of the same size and shape, and a quantity of sand or similar material.

Ask the child to fill the bucket with sand and then tip the sand into the bowls. How many bowls can be filled ?

★

Take a jug of water and find how many cups can be filled from it. Make sure all the cups are of the same size.

★

Fill as many jars as you can from your jug. Empty each jar back into the jug.

★

Take a tea-set cup full of rice and find how many spoonfuls of rice it holds.

★

Find three containers that hold more than a cup.

★

Fill a bowl with water. How many jars can you fill with this water ?

★

Place a selection of appropriate containers on the child's table.

Ask the child to put two cupfuls of water into each container on his table. Which containers are full ?

★

Provide a box and ask the child to find all the boxes that will hold more sand than the box provided.

★

Find all the containers on the table that hold more sawdust than two mugs.

★

Place a selection of containers on the child's table (e.g. beach bucket, jar, bowl, lunch box).

How many cupfuls of gravel do you need to fill each of these containers ?

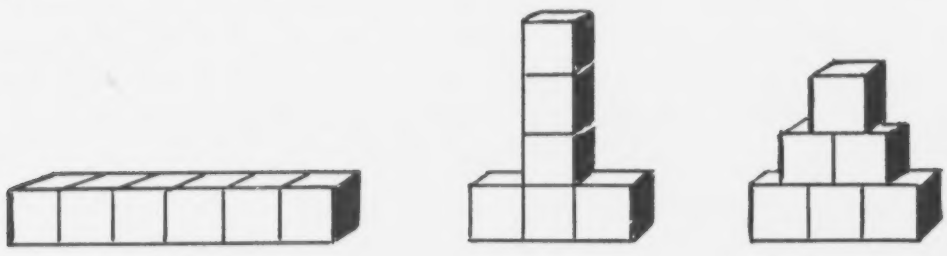
★

Provide a variety of containers and material with which to fill them. Give the child a jar of appropriate size.

Ask the child to put all the containers that hold less than the jar in a special place, for example, on the locker.

★

Use six blocks each time. Arrange them in as many ways as possible. For example :



★

How many beads can you fit in—

an egg-cup ?
a matchbox ?
a small dish ?
a cup from the tea-set ?

★

Find all the containers on your table that hold the same amount as one another.

★

Make something long with your clay.

★

From a big ball of clay make six small things.

MATERIALS AND EQUIPMENT

Sand-pit or Sand-tray : Wet and dry sand, buckets, containers of various sizes and shapes, moulds, sieves, spades, spoons, scoops, funnels, and so on.

Water-tray or Baby's Bath (of good size, plastic preferred) : Also protective clothing and floor covering, mop, funnels, strainers.

Containers—

wide variety in shape and size : lids, egg-cups, plastic mugs and beakers, small jars, and so on.

some related in capacity and of the same shape ; same capacity, different shape ; different capacity, same shape.

of a sufficient number so that the child may fill these to determine the capacity of a larger container :

" This jug of water will fill six of these cups."

Because of the child's limited manipulative skill, small squat containers which are stable are preferable to large, narrow-necked and small-based containers.

Assorted objects that will float—various toys.

Assorted objects that will sink—rocks, lead weights.

Clay and Dough : Careful storage is essential for reasons of both economy and health. The type of container will vary according to the quantity of material on hand, and may range from tightly lidded plastic bowls to plastic bins.

Associated equipment : Scone cutters, butter-pats, plastic covers for tables, clay-boards, rolling-pins or thick dowel rod, simple modelling tools.

Blocks, Boxes, and Filling Materials : Many containers of different sizes for use with " dry " fillings such as beads, beans, macaroni, marbles, peas, rice, sawdust, wheat, and other fillings listed in the materials and equipment section for " Weight ".

SECTION A—WEIGHT

NOTES

Refer also to Stages in the Development of a Topic, pages 12 to 15.

Development of Initial Ideas of Weight

Children come to school with varying ideas concerning the vocabulary of weight. They may have heard the terms " heavy " and " light " ; they may have attempted to lift something and felt the pull on muscles ; and they have probably realized that parents and other adults can lift very heavy things while they cannot do this. Throughout their experience, ideas of weight have been very personal.

These ideas will vary from one locality to another ; for example, in areas where many of the children come to school after attending kindergarten or pre-school centres, most of the children will have played with balances or see-saws. In other areas the children may have gained few ideas, since they have been limited by a restricted home environment.

It is against this background, which varies from child to child, that the teacher must introduce experiences which will clarify thinking and allow a precise vocabulary to develop.

In the early stages of Section A, and prior to the introduction of the balance, the child may gain valuable understanding through guessing games and by using the blocks and prepared material listed in the materials and equipment section which follows on pages 28 and 29. This will involve the judging of weights and the use of such terms as " heavy ", " light ", " heavier than ", and " lighter than ".

Parallel with this, many miming games can be used, and the child's actions will allow the teacher to assess his understanding :

The children are asked to mime the third Little Pig carrying a large load of bricks for his house.

The child who walks on tip-toe with arms outstretched may be lacking in the idea of heaviness.

Vocabulary Books

Vocabulary books are discussed in the introduction to Section A (see pages 10 and 11), and they are of value in assessing understanding as well as assisting in the illustration of words being introduced to widen the child's vocabulary.

Introduction of the Balance

It is important that the child should understand the idea of balance before he uses the balance itself in his weight experiences.

A see-saw is valuable as a means of gaining understanding, since the child himself is able to be " part of it " and can feel what is happening.

When he plays on the see-saw he discovers the conditions under which it will tilt or become level. Later he should be encouraged to

predict these reactions when he watches others use the see-saw as well as when he is using it himself.

If a see-saw is not available, the teacher can improvise, using a plank and a block or cylinder, so that similar experiences may be given to the child. Simple balances may then be used as suggested in the materials and equipment section on page 29.

This work, centred on the gaining of balance experience, is not sequential to the work that is carried out on muscle tension. The two develop side by side. Whenever opportunity arises to discuss the idea of pull on muscles, the teacher should avail herself of it.

Many of these opportunites will arise as the child works with materials and equipment :

John attempts to carry a large bucket full of sand ;

Mary and Anne have to push hard to move a table out of the corner where they want to play ;

Peter attempts to lift all the library books at once.

When the child can use the balance with understanding, the balance can be introduced as a check for the guessing games referred to above and listed in the weight activities on page 28.

As the child uses the balance he should be led to see its relation to the see-saw, and that equality of weight is attained when the arms are level. This should be stressed and no reference made to the height of the pans above the base board. It is also suggested that no vertical pointer be on the balance at this stage.

In general, the balance provides motivation, and few directed assignments are needed if plenty of varied material is available for weighing.

Children may be led to discover that a number of weight relationships exist, and those appropriate to this level are listed as " Outcome—(e) ", below.

It should also be appreciated by the teacher that in using the balance there is an inter-relation between pure and applied number, and that in Section A the child is gaining experience in concepts of equality and difference.

Outcomes

By the end of Section A the child should be able to—

(*a*) compare weights by holding them in his hand, and then check his estimate with a balance ;

(*b*) balance various materials ;

(*c*) order weights ;

(*d*) use a vocabulary with respect to weight ;

(e) comprehend that—

(i) one thing may balance one thing :
a book balances a block ;
a block balances a block.

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(ii) one thing may balance a number of different things :
a bolt balances a bead, an acorn, and a stick.

(iii) one thing balances a number of similar things :
one bead balances five nails.

(iv) two things may balance two things :
one bead and one stick balance one gum nut and one bottle top ;
two screws balance one counter and one bottle top.

(v) one object broken up has still the same weight :
two balls of clay can balance, this balance is maintained even if one ball is broken into several pieces.

(vi) appearance alone is not a reliable indication of weight :
this experience may be gained from games and from the use of the prepared material as suggested on pages 28 and 29.

SUGGESTED ACTIVITIES

Refer also to the notes on the suggested activities for length, page 17.

Use a cupful of each of the following pairs :
Beads and corks ;
sand and shells ;
nails and sawdust.

Ask the child—
Which is the heavier of the two ?
Which is the lighter ?
Are the two cupfuls the same weight ?

★

How many shells are needed to balance—
three stones ?
five sticks ?
four bottle tops ?
six corks ?

★

Supply jars of the same size and shape filled with a variety of materials as suggested in the activity below.

Ask the child which is heavier :
A jar of bolts or a jar of nails ;
a jar of beads or a jar of stones ;
a jar of sand or a jar of wool ;
a jar of rice or a jar of sawdust ?

★

Put ten beads on one pan of the balance. Ask the child—

How many cotton-reels weigh the same as the beads ?
How many counters weigh the same as the beads ?
How many screws weigh the same as the beads ?
How many bolts weigh the same as the beads ?

★

Provide a variety of weighing materials on the child's table.

Ask the child to place a bead, a stone, and a bolt in one pan and then to find out how many of the things on the table balance them.

★

Find two things heavier than a cone. Balance each one of these things with stones.

★

Provide a variety of things to be weighed on the child's table.

Balance each thing on the table with acorns.

★

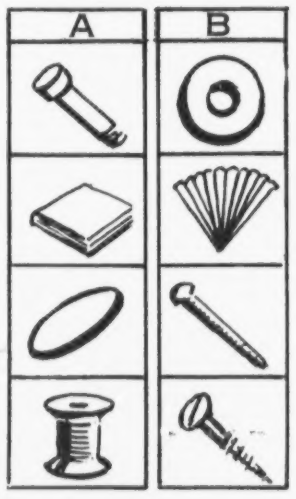
Children, who have tins containing a variety of material, work in pairs. Each child takes turns to find something in his tin to balance something from his partner's tin.

★

Objects to match the pictures are placed in a tin.

The child is asked to balance an object from Column A against its opposite in Column B.

A curtain-ring is placed around the picture of the heavier object of each pair.



★

How many counters are needed to balance—

five nails ?
one duster ?
six pieces of chalk ?
three shells ?
four beads ?

★

Provide three tins of the same size and shape, also quantities of three different materials for filling the tins, for example, sand, wool, and road-metal.

Ask the child to fill each tin with one of the materials, and then to place the filled tins in order, from the lightest to the heaviest.

★

Find five things that are each heavier than a cotton–reel.

★

Find six things that are each lighter than a bolt.

★

Put a cupful of sand in one pan of the balance.

Pour rice into the other pan until the balance is level.

Games

Take Your Pick " : Provide wrapped parcels, similar in appearance but of different weights. Parcels can be identified by means of coloured squares of paper or a variety of cut-out shapes. The children sit in a circle with the parcels in the centre. A child, chosen by the teacher, is given a parcel and asked to find one from the centre which is either lighter (or heavier) than his parcel. When he has made his choice, and this has been checked, he selects another parcel, gives it to another child, and asks that a parcel heavier (or lighter) than this be selected.

Variations :

(i) Parcels of different sizes are used and the child decides the weight, using muscle pull alone. The parcels are passed around the circle for the other children to check the decision.

(ii) As for (i), but all parcels are of the same size.

(iii) As for (i), but after selection the child checks his decision by using the balance.

(iv) As for (iii), but all parcels are of the same size.

" *Pass the Parcel* " : The children stand in a circle. Each child has a parcel at his feet and all parcels are similar in appearance and weight. A new parcel is given to the first child and this is passed as the music plays. The child holding this parcel when the music stops must judge whether it is heavier or lighter than the parcel at his feet. The game continues with a new parcel being introduced for each " turn ".

" *Parcel Chase* " : The children stand in a circle. Two parcels of the same size and of similar appearance, having started with different children, are passed around the circle as the music plays. When the music stops, the two children holding the parcels move to the centre of the circle and compare parcel weights. They each nominate whether they hold the lighter or the heavier parcel. The parcels may then be passed around the circle for the other children to check the decision

or, if the balance has been introduced, this can be used as a check.

Variations in checking and in types of parcels used may be as for "Take Your Pick".

Note.—Parcels for these types of games should be of a suitable size for passing.

Weight differences need to be great in the early part of the year, but may be decreased as the children gain experience.

MATERIALS AND EQUIPMENT

Prepared Material : For comparison and ordering—

Boxes of various types (chalk, shoe, stocking, match) ; plastic containers, opaque and clear ; ice-cream cans ; etc.

Pairs of boxes can be wrapped to make them appear as similar in appearance as possible, sealed, and marked for identification to make sets with—

both boxes same size, same weight ;
both boxes same size, different weights ;
small box, light ; large box, heavy ;
small box, heavy ; large box, light ;
boxes of different sizes, same weight.

Balances : (i) Simple balance, like a "see-saw", made from scrap material.

(ii) Balance to hang from a table, shelf, or wall, made from a coat-hanger. Pans may be made from lids or pie plates and hung from the hanger by string. An alternative is to peg plastic bags to the bar of the coat-hanger.

(iii) Large balance, free standing, easily handled. It is better for this balance not to have a pointer at this stage ; the children can appreciate that equal weights are on the pans when the balance arms are level.

Associated equipment : scoops, spoons, plastic bags, various containers.

Material : Acorns, beads, beans, bottle tops, buttons, corks, cotton-reels, crumbed plastic, feathers, gravel, gum nuts, macaroni, marbles, peas, pebbles, rice, road-metal, sand, sawdust, scrap metal, shells, used torch batteries.

A "mixed box" containing a variety of materials such as matches, toothpicks, ice-cream sticks, and ice-cream spoons.

It is important to include materials which are "heavy" although their size is not great, e.g. bolts, pieces of brick and tile, lead sinkers.

Blocks : Both graded and ungraded in size—

of wood : red gum and balsa ;
of plastic foam or foam rubber ;
sets may be made similar to those suggested above under "Prepared Material".

SECTION A—TIME

NOTES

The Child's Background

Children, at this stage, have an extremely limited idea of time. To them " now " is the point in time which has real significance and to which they can attach a precise and an accurate vocabulary. A reference to things past could embrace events which happened a few minutes, days, or even weeks, ago. Their appreciation of the passage of time is so limited that the correct placing of an event becomes difficult. " Now ", " next ", and " soon " are words which may have meaning through usage, but even with respect to these words precision is not always present. These are three important words relating to time, the understanding of which must be quickly established in the classroom.

Duration of time, when no means of measuring is available, becomes, even to adults, a personal response to a situation :

Two minutes in a dentist's chair may " seem like hours " ;

two hours, in a pleasant situation, can " seem to fly ".

Even as he is trying to develop a vocabulary, the child faces the problem of definition ; both his vocabulary and his understanding differ from that of the adults with whom he has contact :

In spite of being told he got up " late ", he can still be " early " for school.

He knows that school commences "early" in the day, for he generally gets up " early ".

He knows that " late " refers to " dark time " or night when his mother shows concern in case he is " late " for bed.

It is through the teacher's guidance that the child will gain a fuller understanding and be able to minimize the confusions of vocabulary.

The Development of Understanding

Only slowly will the child gain an understanding of time, and the teacher will need to be constantly aware of a number of aspects and problems of this development. Care must be taken to ensure that the introduction of vocabulary is closely linked with physical situations, so that understanding is established. This is a basic principle of all vocabulary work ; but certain abstract ideas must be presented when dealing with time, and concrete material is of no avail. Words such as " soon ", " in a little while ", and " next " can be learnt and understood only through experience.

Attempts to give the child some appreciation of the passage, duration, and relative nature of time present the teacher with problems associated with both static and continuous events :

Can the child appreciate a single event in a series of events ?

Is the school day a series of separate events or is it a continuous "slice of time" from his arrival in the morning till his departure in the afternoon ?

Does the child's use of such words as "yesterday", "tomorrow", "afterwards", "before", etc., indicate that they are understood ?

The realization of chronological order is part of the understanding that the child must develop. Awareness of this lack of sense of sequence comes often to teachers endeavouring to solve the mystery of missing shoes, overcoat, or lunch-box by asking a series of questions based on the queries "What did you do ?" and "What did you do next ?"

Teachers should be aware of the possibilities that exist to link work with time to everyday activities, many of them associated with mathematics. When the child uses concrete or structured material and meaningfully discusses what he has done, such terms as "next", "before", and "after" will become part of his vocabulary :

"I put down the red stick and then I put the blue one beside it."

"What did you do next ?"

"I put the yellow stick on top."

In activities associated with length, weight, and capacity, the teacher encourages the child to attain a manual dexterity in the location and the use of concrete aids, and so to develop understanding. In dealing with time, analagous to this, the teacher encourages the child to attain, as it were, a mental dexterity in the location and the use of cues in relation to time. This provision of "time cues" or points of reference is important and is discussed further in the section on routine which follows. The basic problem for the teacher is to assess the relationship between conscious development and intuitive gaining of understanding of time, and this could be exemplified in the question : "Does the child at this stage appreciate sequence because he comes to know a routine, or does he appreciate the routine of the day because he has developed a consciousness of sequence ?"

These aspects of the work on time do not apply merely to Section A ; they will be part of the child's background and the teacher's work throughout at least the child's first two years at school.

Routine

The child's interest will centre on two types of routine :

His personal routine, established in his environment away from the school, expressed as "What I do", and having key points such as bedtime, bathtime, "when Daddy comes home", and the like ;

his school routine, when he begins to think in terms of "What we do", and reference points can be playtime, after milk, lunch-time, home-time, and so on.

Teachers of infant grades will appreciate how important routine can be to the child's sense of security within the classroom. A great deal of incidental teaching related to time can be carried out in conjunction with this routine, especially in establishing time cues :

"*Before* play we have our milk."

"*After* play we have reading, *then* we have lunch and a *long* playtime."

Routine implies the repetition of events, either hourly, daily, or weekly, and should this be broken, particularly without advance warning having been given to the children, the reasons why the changes have occurred and what the new arrangements are should be given.

Eventually the teacher will decide that significant times of the day can be used in conversation :

"We have tea at six o'clock."

"I go home at three o'clock."

However, it must be remembered that in the early stages of the child's development "six o'clock", "three o'clock", and similar verbal symbols become labels for times or events, and their use may not imply that the child understands their meaning or that a formal unit of measurement is intended.

It would appear that significance and immediacy are related in the child's mind so that these become the basis upon which much vocabulary is understood. "Now", "not now", "soon", and "in a little while" are all among the first of the "time words" to be understood, and this could be because the events of the child's life are shaped by these expressions from his early days :

"We will go for a walk in a little while."

"I can't come now, I'll be there soon."

"Please, can I have my chocolate now?" "Not now, but after you have had your dinner."

The Days

"Today" is a word with more meaning for the child than "tomorrow" or "yesterday", and these three important words will need to be established in the child's vocabulary. Part of this understanding may be gained by linking these words to the events of the week :

"Mary will have a birthday tomorrow."

"It was very hot yesterday."

It is normal for the child at this stage to be able to grasp this "time span" of three days, and some children may be led to widen the span by means of nonsense rhymes and stories. In many cases, until understanding is gained fully, events prior to "yesterday" occurred a "long time ago", while the day after tomorrow is well into the future.

The child will be assisted in his understanding of these and other vocabulary words as the teacher uses them incidentally in her discussions with the children. It is also in this way that the child gains his knowledge of the names of days of the week, and as these become linked to the various aspects of school routine so the names become more meaningful.

Experience books, news boards, and notices, as discussed on the activities pages, can be valuable adjuncts to this work.

Outcomes

By the end of Section A the child should—

(*a*) appreciate the sequence of significant parts of the day—morning, afternoon, and night ;

(*b*) appreciate the idea of a daily routine ;

(*c*) be able to use a vocabulary related to time and within the limits of his understanding, such as " now ", " later ", " in a little while ", " next ", " after ", and " before ".

SUGGESTED ACTIVITIES

As has been suggested in the notes on Time, the experiences with time in Section A are informal. The following activities suggest ways in which this topic may be treated incidentally.

Experience Books

Experience books are gradually built up as a result of class discussion centering on an interesting topic. These books consist of sentences written by the teacher and describing the illustrations contributed by the children. Topics may include the seasons, festivals (Easter, Christmas, Show Week), and school events (" Our Day at School ", "A Trip to the Gardens ").

An experience book labelled " Our Trip to the Zoo " may contain the following sentences :

Soon we are going to the zoo.
Five mothers are coming with us.
We will leave early in the morning.

On Wednesday we must bring money for our fares.
We need 25 cents.

Tomorrow we are going to the zoo.
We must bring our lunches and cups.
We must have name tags.

Yesterday we went to the zoo.
The animals were very interesting.

Meredith threw some bread to the swans.
This is Fiona feeding the bears.
Patrick gave the monkey a banana.
We all had a ride on the little train before we went home.

" News " Board

As the children become familiar with the routine of their day, the teacher may use this knowledge for informal chalkboard reading.

As a result of a brief discussion the following sentences may be written :

These are the things we will do this morning.
We will sing : " Thank You for the World so Sweet."
Today we will write on paper.
We will drink our milk and then go to play.

As these events take place the children may tick them off. This experience is linked, of course, with pre-reading and other subjects.

Notices

These can be related to current events :

We will go home early to-morrow.
When the bell rings it is time for school.
*The bell rings at nine o'clock.
*John goes to bed at seven o'clock.

* Used later in the year.

MATERIALS AND EQUIPMENT

Clocks : Working classroom clock ; old clock with synchronized hands for children to use ; alarm clock with bells in working order.

Clock-face : With movable hands.

SECTION A—MONEY

NOTES

The Child's Background

Knowledge of money is largely an environmental experience. Many children come to school with little, if any, idea of money, its value, or its use. The country child may live in an environment where goods are purchased at the store, an account is rendered, and no money is seen to change hands. His parents may pay school accounts by cheque, and so money may not even enter his school life. Even in the city, where the child has gone shopping with his mother from a very early age, the supermarket tends to blur early impressions of buying and selling.

Some children reach a stage where shopping is included in their play at home, even in a crude form where something may be " sold " to mother in exchange for a scrap of coloured paper or a bead. This play continues when the child attends a pre-school centre or a kindergarten and plays shop with his peers.

The Preparatory Grade

It is important to realize that many of the activities of the classroom with respect to " teaching money " can only be carried out in an artificial situation. Much activity will centre on the " shop " set up in the classroom, where plastic coins, empty packets, and cardboard tokens are all used, and the children realize that " stock " will be returned to the cupboard and that they have not really bought anything " for keeps ".

Because of this, the children accept inaccuracies in " prices ", and the concepts they begin to develop are very general. It is only in real life that they can gain any true idea of the value of money or the worth of an article.

Two important relations begin to be developed in the early school years. These may not be fully understood until the child is well past Section A, but it is important that the teacher should bear them in mind as the work of this section develops.

The two relationships are :

(i) There is a comparative value between objects ; an ice-cream may be worth 5 cents and a football worth $5.

In Section A the child is not expected to appreciate anything more than that some things are worth more than others, but even here some aspects of real life may add confusion :

(*a*) Value can be dependent upon the desire to possess.—The child is willing to exchange an expensive toy (by adult standards) for a cheap one, merely because he wants the latter.

(*b*) Value, measured by money, can change.—Prices vary and articles which seem the same to the child may vary in price. This is an idea which arises only after the child has the opportunity to buy for himself.

(*c*) Things may be " cheap " or " dear ".—The child may not be able to appreciate these ideas, but the terms may be part of his home environment and he may have some understanding of their meaning. In his work on length the child finds that his table is *always* ten blue sticks long or his red block *always* weighs the same as three bolts, but with respect to money the value relationships can alter.

(ii) There is an equivalence between coins which cannot be readily checked and must be learned :

The child will be told that two 5-cent coins, ten 1-cent coins, and one 10-cent coin represent the same value, but he cannot check this in the same way that he can check the relationship between the length of a block and the length of a train he has made, or the weight of his block against the weight of a number of acorns.

If the child leaves Section A appreciating—

(i) that payment is an integral part of buying ; and

(ii) that the person who pays is the buyer and the person who accepts payment is the seller,

then the foundations have been laid for further understanding in future sections.

The " shop " will provide many opportunites for vocabulary work, and further experiences may arise from school activities such as : Toffee days ; the canteen ; school bazaars ; social service activities ; bus and train fares connected with excursions ; shopping excursions ; the school bank—though this will be merely incidental in Section A and will feature more in Section B.

Development in Section A

(i) Exchange using coins :

(*a*) Any number of coins for one article ;

(*b*) one coin for one article ;

(*c*) the value of the article is denoted by dots on the " price ticket ", and the child presents this number of coins (irrespective of their value) in exchange for the article.

(ii) Purchasing more than one article :

Here it is better for the child to buy each article separately and so avoid an addition situation.

Teachers will be aware that in many areas the child will be able to recognize coins, having used them outside the classroom. Formal coin recognition is not part of Section A but comes in Section B.

Problems connected with money must be within the framework of pure number and within the range of any operations carried out in that area. Coins and tokens may be used, particularly in the later work of this section, in grouping activities, and this will become an introductory activity for the work of Section B.

It can be seen that most of the work in this topic centres on play situations which the teacher uses as focal points for discussion and vocabulary work.

Outcomes

By the end of Section A the child should—

(*a*) be able to use an understood vocabulary in relation to money ;

(*b*) give a number of coins for a selected article, such a number to be indicated by dots and be within the limits of his pure number knowledge ;

(*c*) realize that there is, in any transaction, a buyer and a seller ;

(*d*) have some tentative ideas concerning value.

MATERIALS AND EQUIPMENT

Classroom Shop

This may be permanently set up in the room if space permits ; or a table or a bench with shelves, if possible, should be kept to use as a shop when needed.

Stock—anything the children suggest—toys, books, blocks ; empty packets, tins, containers.

Money—cardboard tokens, plastic coins, one-cent and two-cent pieces.

Price tickets—as suggested in the notes—

(i) " price " denoted by dots ;

(ii) " price " denoted by numerals.

SECTION A—SPATIAL RELATIONS

NOTES

Pre-school Activities

By the time the child comes to school he has established for himself an awareness of certain aspects of his environment :

(i) The child manages his own gross body movements in space. He can run, walk, and move about without bumping into obstacles ; he can relate his position to that of objects, and so knows that he must sometimes bend, stretch, or reach out to touch things or to pick them up.

(ii) The child appreciates, though he may not be able to define, certain physical properties of the things he handles (a ball is round, a piece of paper is thin, a book is thick) and he is able to adjust his movements and his actions to handle these successfully.

(iii) He has explored his environment. This began at an early age when the cot or the play-pen defined the limits of movement ; here his exploration using touch, his movement, and his stretching were confined, but he was able to visually explore even further. As he grew older the limits expanded and at pre-school age he has ranged outside his own home boundary, both alone and with others.

The Preparatory Grade

During the child's first year at school, the teacher will provide opportunites for pre-school activities to be widened and will also assist the child to develop a vocabulary in order to describe or to explain what he is doing.

(i) **Body Movements** : Here the work will be linked with other sections of the curriculum, particularly rhythmic work and games.

(ii) **Environment** : Until the child comes to school his movements are personal and his ideas of position are related solely to himself. He thinks in terms of movement to a specific location, from A to B, not in the wider sense of the relationship of space around him.

Under the guidance of the teacher he will begin to know his immediate school environment—the limits of his playing area ; how to get from one place to another—and from this will arise his ability to describe position without movement to it.

Activities which will centre on his knowledge of his right and his left are the problem of wearing shoes, slippers, and gloves, and the saluting of the flag at assembly. A realization of the meaning of the terms "front" and "back", which will become associated early with the

donning of clothes, can lead to the further idea of " sides " and then to the specific terms " right " and " left ".

(iii) **Physical Properties** : Much of the child's awareness of physical properties and the vocabulary associated with this work will come from the handling of concrete aids in other aspects of his number work. This will be furthered as he comes to consider the property of shape. From his free play he will find that shape can be important—blocks of a certain shape are stable on flat surfaces, whereas cans and balls can be made to roll.

(iv) **Shapes and Environment** : As the child develops the ability to recognize certain shapes he should be led to look for these in his environment. Often, in his free play, he will put shapes together and these will suggest something he sees in his environment ; often he will see something and " translate " it into a formal shape.

The awareness of shape can be consolidated in the child's mind by the use of things such as the following :

Inset boards—
- simple geometric shapes ;
- shapes related to pictures on the board.

Blocks in a wide variety of shapes so that the child can choose—
- triangular blocks for a roof ;
- long, flat blocks to make a train ;
- large-based blocks to make a floor ;
- a number of arches to make a tunnel.

Materials for creative work—
- paper shapes, coloured paper, scissors, paste, so that the child may either make his own shapes or create new shapes from existing shapes.

Creative Construction

The teacher will find many opportunities, not merely in the mathematics time, to provide for the child to have experience in " making things ". During Section A it is of value to allow the child to use his materials and then to pass on, in discussion, those ideas he has relating to " naming " what he has made. As indicated above, both two-dimensional and three-dimensional material should be used, but the child should also be allowed to explore the interiors of boxes and hollow shapes.

Reading Readiness Activities

It is important to realize the overlapping that occurs between much of the work concerning shapes in Section A and the pre-reading activities generally used in the preparatory grade. Many of the charts that are available, the exercises involving selection of similar and different shapes, and other activities can be used also as part of the work for spatial relations.

Vocabulary Books

Reference should be made to the discussion of vocabulary books in the introduction to Section A (see pages 10 and 11). A special book may be made for spatial relations and labelled "Shapes Book".

From his work the child will come to recognize certain shapes which occur frequently : The circle, the square, the triangle, and the star. By the end of Section A he should be able to name, but not define, these shapes.

Outcomes

By the end of Section A the child should—

(*a*) be aware of, and be able to match, a variety of shapes ;

(*b*) be able to identify and name, but not to define, circles, squares, triangles, and star shapes, and to identify similar shapes in his environment ;

(*c*) be more fully aware of the space he requires for a wider range of body movements than those he could carry out before he came to school ;

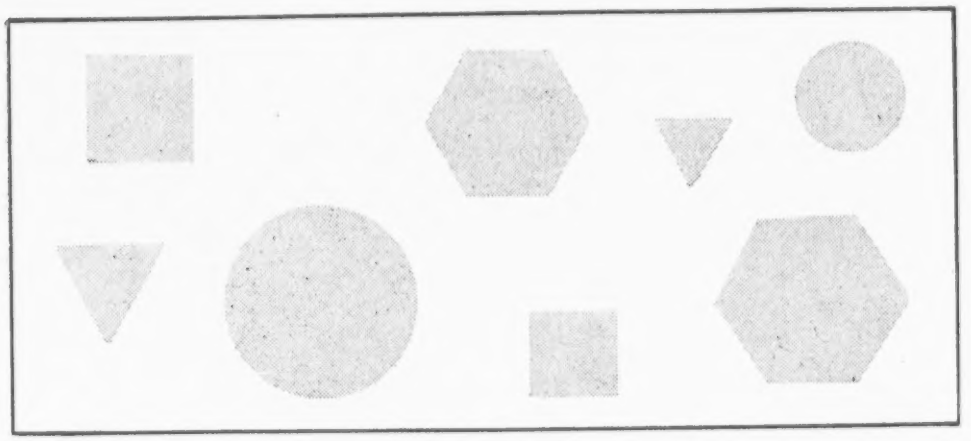
(*d*) have a knowledge of his own section of the school environment ;

(*e*) have some understanding of the terms " right " and " left ".

SUGGESTED ACTIVITIES

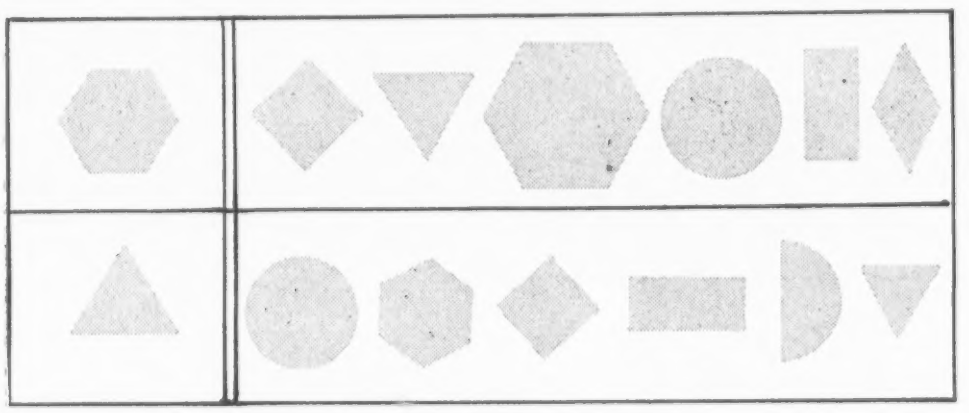
Refer also to the notes on the suggested activities for length, page 17.

Join together with a line things that are of the same shape :



★

Put a curtain-ring on the shape most like the shape in the box :



Note that a similar card can be prepared using pictures of objects in place of the shapes on the right.

★

Use blocks of two different shapes to make a pattern.

★

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Use blocks of the same shape, in two different colours, to make a pattern.

★

Find all the things in the room that are of the same shape as your handkerchief.

★

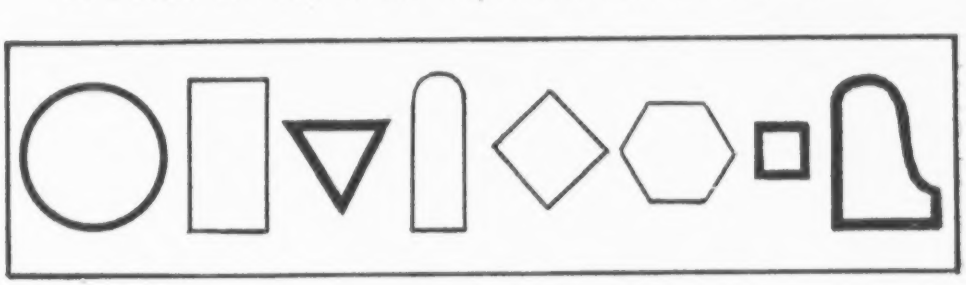
Make a wide road with your blocks. Make a narrow footpath beside it.

★

Put all the square blocks inside this hoop.
Put all the round blocks outside the hoop.

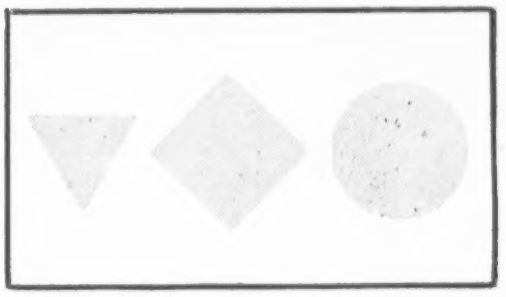
★

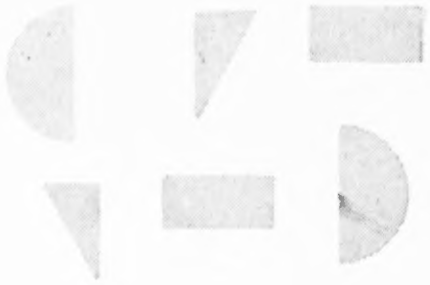
Put a block on each of the shapes that have a thick outline :



★

Find two shapes from those on the right that you can put together to make these shapes :





★

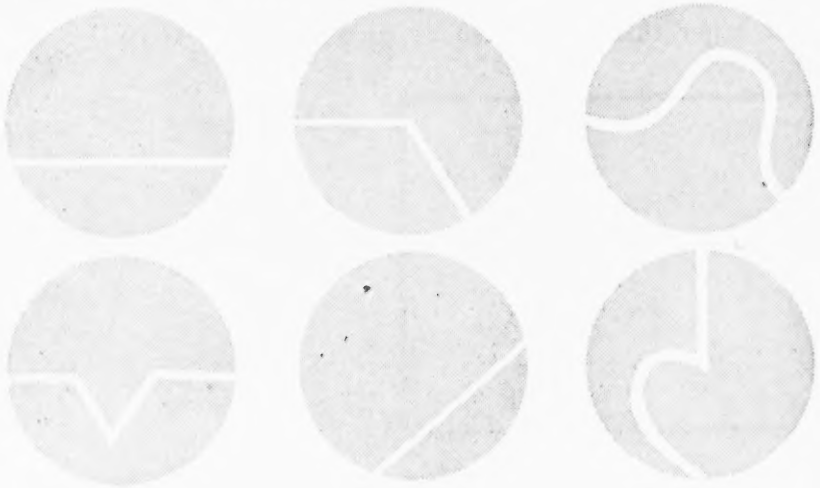
The children are given a variety of shapes and asked to sort like shapes into boxes.

★

Squares and triangles are cut from coloured paper. The children use these to make patterns. Allow the children to cut their own shapes if they wish to do so.

★

The child is asked to fit pieces together to make complete circles. Other shapes may be used.



★

Children are given a variety of shapes in a variety of sizes and asked to sort them according to shape and size.

★

Shapes cut from cardboard or wood can be used for—

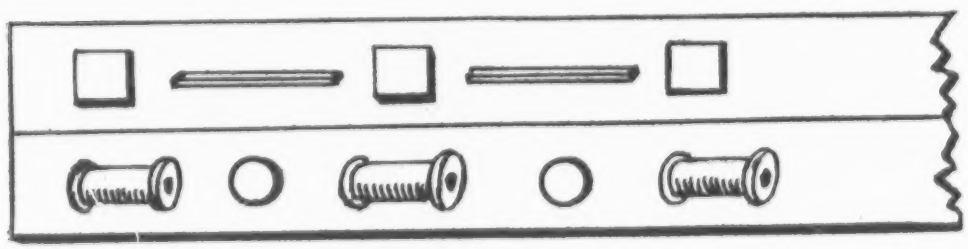
sorting according to shape or colour ;
ordering from smallest to largest, or the reverse ;
making patterns ;
making new shapes by putting two or more shapes together.

★

Make a high building using interlocking blocks.
Put a low shed beside it.

★

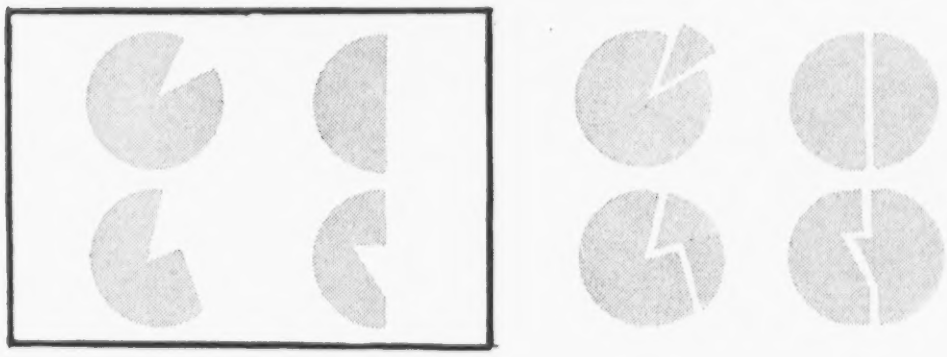
Continue this pattern using real objects instead of the pictures :



★

The teacher cuts circles from coloured card and cuts each circle into two parts. She then traces one part onto white card. The child is asked to match and complete the circle on the card.

Shapes other than circles can be used.



★

Make three balls from clay. Make flat shapes from some more clay. Put one ball on top of a flat shape. Put another ball under a flat shape. Put the third ball beside the flat shape.

★

Use bands of different colours to make shapes on your geoboard.

MATERIALS AND EQUIPMENT

Blocks : Of various shapes and sizes, both regular and irregular ; interlocking blocks.

Inset Boards : Simple geometrical shapes ; shapes related to the picture on the board.

Mosaic Sets : Of cardboard, wood, plastic, or other material.

Shapes : Triangle, square, circle, star ; of common objects in silhouette—fish, flower, leaf, animals, etc. ; made of wood, felt, plastic, plastic foam, card.

Materials : As used for grouping activities and as suggested for weight, length, and capacity can also be used for spatial relations.

Materials for making shapes include—

(i) paper, scissors, light card, paste ;

(ii) clay, rollers, scone cutters, dough.

Charts : From Visual Education Branch or in books and as used in pre-reading activities.

Nesting Blocks.

Geoboards.

SECTION B

INTRODUCTION

Aims

The aims of Section B are the same as those for Section A, but because of the experience gained in the earlier section and the mental growth of the child it is now possible to lead him towards—

(i) a more precise vocabulary—ideas of comparison become more refined and measurement becomes more exact ;

(ii) a better understanding of measurement in terms of units—he is led to see that—

an appropriate unit of measurement is needed ;
comparison of measurements demands a common unit.

Units

It is in Section B that the child becomes interested in the choice of units. Experience will lead him to appreciate that it will take a long time and much effort to fill a large container using a small measure. As he endeavours to minimize his effort, so he comes to see that the unit, to be effective, must be also appropriate :

He measures water into a bucket using a jug rather than a teaspoon ;

he tells the weight of a large block more easily when it is weighed against bolts, and a small block when it is weighed against acorns ;

he discovers that it is easier to express the width of the room as a number of paces rather than as a number of matchboxes.

As the children work together in groups and compare results, they discover that if one group measures by using sticks and another group measures the same length by using blocks, the answers will vary numerically :

" Peter says the chair is seven matchboxes wide. John says it is three sticks wide. Who is right ? How can we find out ? "

From discussions of this and similar situations, the children come to see that the comparison of results can only be meaningful when the same unit is used.

After the children have worked with any appropriate common unit for some time they will meet the problem of trying to communicate measurements with people outside their classroom. They are then ready to proceed to Section C, where the formal units are introduced.

Estimation

Throughout this section the child will meet situations which will challenge him. He should meet these situations confidently and be able to tackle their solution in a variety of ways :

Find all the things that are the same weight as this stone.

How many different shapes can you make using four triangle shapes each time ? Can you match any of your new shapes with any of the shapes in this box ?

The child should be encouraged to use his intuitive powers and to guess, or estimate, before seeking a result by measurement. The value of the course is seriously curtailed if this aspect is neglected. In fact, the central themes of the work are understanding through experience and the development of the child's ability to estimate, compare, and use the means at his disposal to check the accuracy of his solution. For example, the child, presented with the problem of measuring, using multiple units, may have to make three decisions. He must—

(i) choose his unit ;
(ii) estimate his result ;
(iii) devise some means of tallying his count.

Once these decisions are made he is able to check his estimate.

Often his unit is chosen for him if he is carrying out a directed activity :

How many cupfuls of rice will fill this chalk-box ?

(i) Here the unit is chosen.
(ii) The child will have to estimate his result.
(iii) He will then have to decide how to check this estimate, and this will involve the tallying of his count. Three methods are possible :

Pouring the rice into a series of similar cups and then counting these.

Pouring the rice from box to cup and then from cup to a heap on the table. Continuing this until the box is empty. The number of heaps is equivalent to the number of cupfuls of rice contained in the box.

Pouring the rice from box to cup and from cup to plate. Continuing in this way until all the rice is transferred to the plate, and hoping to remember his count as he proceeds.

It can be seen that it is essential to provide equipment that will allow the child to use a number of containers of the same size or standard units of length or weight, so that the child may choose his own method of solution.

The work with estimation may begin in Section B, and in later sections the child should always be asked to estimate before measuring. Teachers will appreciate that if this practice is continued throughout the course, the child will develop a desirable skill as well as achieve greater understanding.

Dividing and Combining Material

In working with quantities concerned with length, weight, and capacity, the child's experiences may lead him to discover that these

quantities can be divided into parts and then reconstituted without loss :

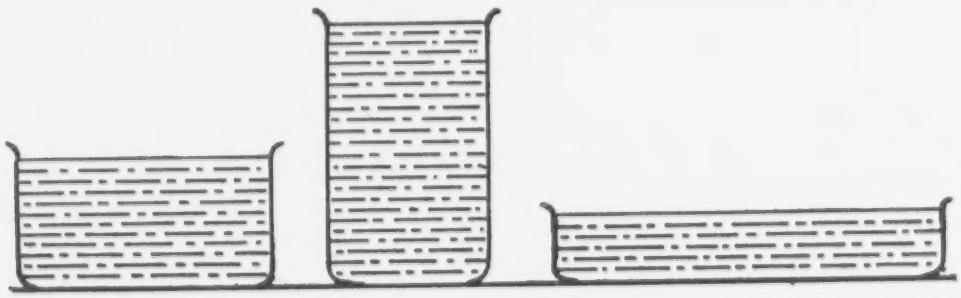
A jar of water may be used to fill six small containers. When these are emptied into the original container no water is lost ; the amount of water has remained constant even though divided among the six containers.

The total length remains constant even if a piece of string is divided into a number of parts.

A cupful of sand will remain a constant quantity even though divided into four parts.

Although, to the adult, this understanding is immediate, young children take some time to appreciate it. In their early days at school they may believe that a group of six counters placed close together is a different amount from the same number of counters spread out :

This idea is even more difficult for the child to understand when the quantity is continuous, for example, when he is using water. When this is poured from one container into another of a different shape it can be difficult to appreciate that the same amount is involved.



Vocabulary

Vocabulary continues to be a feature throughout Section B, and this involves the consolidation of the words learned and understood in Section A as well as an extension brought about by both incidental and directed teaching.

Teachers should be constantly aware that many words may be used in a variety of contexts, and thus their meanings are different :

" What a happy face !"

" Look at the clock face."

" Face the door."

" Put it face down."

" Stand face to face."

Because of this it is important that these words be used as often as possible in their various contexts to give the child an opportunity to appreciate differences in meaning.

SECTION B—LENGTH

NOTES

The work of this topic follows closely that outlined in the introduction to Section B, and its development can be seen from the suggested assignments listed on the activities page.

Units and Equality

When asked to compare lengths, the child, depending upon his experience, will use—

(i) varied units :
"My table is as long as two blocks, one stick, and a book."

(ii) units of the same size placed in position and counted :
"My table is eight blocks long."

(iii) a single unit used as a "measurer" ; that is, the unit is moved along :
"My table is twelve pencils long."

It is in Section B that many children begin to measure more precisely, and with this goes a development of vocabulary from the language that the child uses spontaneously to a more precise definition :

"The cupboard is five sticks long and a bit more."
"The cupboard is nearly seven books long."
"The cupboard is six blocks long."

Teachers will readily appreciate that work on appropriate common units will be developed closely along these lines.

Outcomes

By the end of Section B the child should—

(*a*) be able to measure using appropriate units ;

(*b*) realize the need for a common unit ;

(*c*) have some ability in estimating ;

(*d*) have a better appreciation of equality and be able to demonstrate it more precisely ;

(*e*) have extended his vocabulary, and his understanding of it, beyond that of Section A.

SUGGESTED ACTIVITIES

Notes

(i) These activities are suggestions only and are not presented in any sequence of development.

(ii) Many of the activities may be presented in a written form, that is, used as a basis for assignment cards adapted to the child's reading ability.

(iii) In a number of instances cards may be prepared so that results of the activity may be readily recorded by completing sentences or by adding numbers to spaces on the card.

(iv) The suggested activities may be adapted to provide easier or more difficult tasks, or may become the core of a graded series of activities.

(v) Assignment cards may assist in the organization of a period, but it should be remembered that discussion with the child is the most effective method of evaluating the child's understanding.

Activities

Children work in pairs. Child A uses an icy-pole stick as his unit of measurement, child B uses a matchbox.

Measure—

the length of two cupboard doors ;
the width of the library ;
the width of your table ;
the length of your table.

Are your answers the same as your partner's ?

★

Provide a variety of materials to be used as units of length : Counters, one-foot lengths of wood, six-inch plastic sticks, one-inch blocks, etc.

Use whichever unit seems best to measure—

the length of the long ruler ;
the length of a small book ;
the width of the room ;
the height of your chair ;
the length of your chalkboard.

★

Find five things in the room which are of almost the same length as four matchboxes put end to end.

Measure with counters each of the things you have found.

Did you need more than four counters for each thing ?

Why ?

★

Cut two pieces of streamer each of the same length.

Cut another five pieces longer than these.

Cut four very short pieces.

Measure each piece with counters.

Paste your streamers on paper to make something interesting.

★

Cut a streamer to be the same length as—

2 matchboxes end to end ;
4 matchboxes end to end ;
6 matchboxes end to end ;
1 matchbox ;
5 matchboxes end to end ;
3 matchboxes end to end.

Put the pieces in order of length.

Paste them on paper in that order.

★

Use your feet [shoes] to measure the length of the room and the width of the room.

Copy the sentence that is true :

The width is greater than the length.
The length is greater than the width.

Now use your feet to measure the width of the shelter shed and the length of the shelter shed.

Copy the sentence that is true :

The width is greater than the length.
The length is greater than the width.

★

Choose five different things that are in the room and measure each of them first with streamer, next with string, and then with tape.

Sort the pieces of streamer, string, and tape that you have cut according to their length.

Put a pencil, two sticks of chalk, and a milk straw end to end and measure the length of these :

They are as long as—

- ☐ plastic sticks ;
- ☐ matches ;
- ☐ counters;
- ☐ pieces of chalk ;
- ☐ milk straws.

★

Find two things in the room each as long as the other. How do you know you are right ?

Measure the things you have chosen in at least three different ways.

Can you find anything else of the same length in the room ?

★

Measure to find which are true. Write YES or NO.

The library is nearer the nature table than the big cupboard. ☐

The door to our room is wider than the door of the cupboard. ☐

The height of teacher's table is greater than the length of the table. ☐

It is further from the library to the door than it is from the door to the library. ☐

★

Provide an unmarked stick which is one foot long.

Place this stick on your chalkboard and mark where the ends of the stick come. Put the stick away.

Guess first, then measure, then fill the gaps :

- ☐ counters can fit between the marks ;
- ☐ plastic sticks can fit between the marks ;
- ☐ buttons can fit between the marks ;
- ☐ matchboxes can fit between the marks.

★

Look at this stick. Put it out of sight. Now try to find four things almost as long as the stick.

Measure them against the stick. Were you right ?

★

Provide two sets of linear material so that the lengths in Set A match those of Set B. The sets are placed some distance from each other. The child selects and looks at a length from Set A, replaces this, and tries to find a matching length from Set B. This is checked against his original choice.

An activity such as this may be used as the basis for a game using teams, or for the children to score individually.

★

Provide an unmarked stick one foot long, plastic sticks in three sizes, and counters.

Make a line of short plastic sticks as long as this stick.
How many counters do you need to measure this line ?
Guess first and then check.

Make a line of plastic sticks of medium size as long as the stick.
How many counters do you need to measure this line ?
Guess first.

Make a line of long plastic sticks as long as the stick.
How many counters do you need to measure this line ?
Guess first.

What did you find out about the numbers of counters you needed to measure each line ?

SECTION B—VOLUME AND CAPACITY

NOTES

The work of this topic follows closely that outlined in the introduction to Section B, and its development can be seen from the suggested assignments listed on the activities page.

Units and Measurement

The work of this topic, like that for length and weight, leads to the appreciation of the need for an appropriate, and also for a common, unit of measurement.

As the child attempts to solve the problem of comparing capacities, a necessary prerequisite is that he should have an understanding of the ideas of "full" and "empty". It is also important that he should have achieved a certain amount of manual dexterity during Section A and be able to pour, fill, and empty with little loss of material.

The appreciation of the need for an appropriate, and for a common, unit will arise from situations similar to those discussed in relation to length and weight.

Packing

Valuable experience can be gained by the child when he packs materials and objects into containers. He has environmental experience in packing and unpacking his lunch-box, schoolbag, locker, and other things. More formal activities can be developed by the teacher so that the child can discover variations which occur with respect to size, shape, and number of articles which can be packed.

How many of these blocks can you pack into this chalk-box ?

How many balls will fit into this chalk-box ?

Provide two boxes of different sizes and blocks of two different sizes so that each box can only be filled by one size of block.

("Fill" here denotes that the blocks must pack in so that they are level with the top of the box.)

Ask the child to sort the blocks and fill each box.

Other similar exercises can be introduced in simple form in Section B and developed so that work on volume can be extended in later sections.

Estimation

Throughout the work of Section B the child should be asked to guess his probable results and encouraged to check these guesses by measuring. It is also important that he should be provided with a variety of materials such as clay, dough, water, sand, and grains.

Work in ordering and in comparing should be continued and linked throughout to the activities for this topic :

Find the tin that holds two cupfuls of water. Now find the bottle that holds the same amount of water.

For each of these tins measure the water that you use to fill it. Place the tins in order, smallest to biggest.

How many cupfuls of rice do you think this box will hold ? Guess first and then check to see if you were right.

Fill this bottle with water. Guess how many cups it will fill.

Pour the water into cups. Were you right ? Now pour the water back into the bottle. Is it full ?

Outcomes

By the end of Section B the child should—

(*a*) be able to handle materials and equipment used in capacity work confidently and efficiently ;

(*b*) have an appreciation of the need for both appropriate and common units of measurement ;

(*c*) have some ability in estimation ;

(*d*) have a more precise understanding of equality and inequality ;

(*e*) have extended his vocabulary, and his understanding of it, beyond that of Section A ;

(*f*) be able to unpack and repack boxes of materials more efficiently.

SUGGESTED ACTIVITIES

Refer also to the notes on the suggested activities for length, Section B, pages 48 and 49.

Provide cup, spoon, and jug to act as units of capacity, and a variety of containers. Children are asked to select the appropriate unit and to measure the capacity of each container.

★

Provide six containers of different shapes, pairs of which match in capacity.

Guess which containers hold the same amount as each other.

Now measure. Were you right ?

★

Provide a collection of containers of different capacities, and three or four which vary in shape but are of one-pint capacity.

Find all the containers that hold as much as this milk bottle when it is full.

Find all the containers you think will hold more than a full milk bottle.

Measure them. Were you right ?

★

Find a container you think holds—

more than a full milk bottle ;
less than a full milk bottle ;
the same as a full milk bottle.

Put them in order.

How many cupfuls does each container hold ?

★

Provide sticks of chalk and a tin of appropriate size.

How many pieces of chalk do you think will stand up in this tin ?

Pack the tin with sticks of chalk.

How many sticks does it hold ?

Was your guess right ?

★

Provide the lid of an ice-cream can and some clay.

Fill the inside of the lid with clay. Smooth it with a stick or roller so that the lid is just filled.

Take the clay out of the lid and make one large ball.

Put the ball into the lid and fill the lid again.

Now use all the clay to make two bananas.

Press these out to see if they will fill the lid.

Use all the clay to make four flat things.

Press these out to see if they will fill the lid.

Now use your clay to make something very long.

Press this into your lid and see if you can fill the lid with clay.

Use all your clay to make something tall.

Press all the clay into your lid.

What did the clay do each time you put it into the lid ?

★

Provide a stock of blocks of three different sizes and a box.

Sort these blocks according to size.

Guess how many large blocks you need to fill the box.

Pack the large blocks into the box :

☐ large blocks fill the box.

Guess, then pack the middle-sized blocks into the box :

☐ middle-sized blocks fill the box.

Guess, then pack the small blocks into the box :

☐ small blocks fill the box.

Which blocks filled the box most quickly ? Why ?

★

Provide cups of the same size and shape, rice, and a large-mouthed jar.

How many cupfuls of rice will fit into this jar ?
How many cups can you fill from the rice in the jar ?
Guess first and then measure.

★

Provide a mug, a cup, and a jar, all of equal capacity ; a small bucket ; and sand.

◯ mugfuls fill the bucket.
◯ cupfuls fill the bucket.
◯ jarfuls fill the bucket.

Guess how many jarfuls will fill a mug.
Now measure.

★

Provide a container which holds half a cupful, a cup, a jug, and a small bucket.

Measure to find how many—

□ containers fill the cup ;
◯ cups fill the bowl ;
△ containers fill the bowl ;
◯ cups fill the jug ;
△ containers fill the jug ;
◯ cups fill the bucket ;
△ containers fill the bucket.

★

Provide three boxes of different sizes and shapes, and square beads or blocks of uniform size.

Put the boxes in order from the one you think holds the most to the one you think holds the least.

Pack each box with blocks.

The first box holds □ blocks.
The second box holds □ blocks.
The third box holds □ blocks.

Were you right ?

★

Provide clay.

Use all your clay to make something round.
Use all your clay to make something long.
Use all your clay to make four balls.
Use all your clay to make seven sausages.
Use all your clay to make one animal.

SECTION B—WEIGHT

NOTES

The work of this topic follows closely that outlined in the introduction to Section B, and its development can be seen from the suggested assignments listed on the activities page.

The Balance

It is important to realize that the child needs to develop skill in the use of the balance. In Section B, the child becomes more precise, both in his judgment and in his handling of materials.

The child must be led to appreciate two basic ideas :

(i) To attain equal weights in the pans the arms of the balance must be level.

It is the balance arms that provide the check for equality, not the height of the pans from the baseboard. The position of the arms and the pans in relation to eye-level may be an important factor in deciding which the child will use when using the balance, and teachers should consider this in relation to table or bench height when setting out equipment.

Although the child may look at the pans when using the balance, his attention should be directed by the teacher to the position of the arms as well.

The pointer, which may be attached to the centre of the arms, is an indirect indication of balance. The experiences of the see-saw and the work of Section A should have led the child to appreciate this, but it is a more difficult idea and no stress should be placed upon it at this stage.

(ii) Balance can be attained by the addition or the removal of material from the pans.

This is a form of estimation. The child discovers whether the quantity of material he has added to the pan is too great or too small by the position of the arms. Estimation begins when he adds or removes material so that the arms will rest level.

By watching the child weighing, the teacher is able to assess his degree of understanding ; the child who removes a teaspoonful of sand when the arms are almost level shows a greater understanding than the child who removes a cupful.

Teachers should be aware that in the early stages of weighing the children seem averse to removing material but tend to achieve balance by adding it. To see a child removing material is an indication that he has achieved a higher level of understanding.

Assignment work should show a progression in the development of this skill and understanding :

Using blocks, weigh these three parcels and then place them in order, heaviest to lightest.

How many cotton-reels do you think will balance this piece of lead ? Guess first and then weigh.

Put a small paper plate on each pan of the balance. Add a cupful of sand to one plate and then, without using the cup, add sand to the other plate until the arms are level.

The important properties of equality which the child will use in his work in pure number can be demonstrated with the balance. Teachers should plan exercises that will show :

(i) The same weight added to each pan allows balance to be maintained.

(ii) The same weight removed from each pan allows balance to be maintained.

The Choice of Unit

As the child develops an understanding of the idea of weight and gains an appreciation of the materials he handles, so will he be able to judge the most appropriate unit of measurement to use when he is asked to weigh something :

A small block will be weighed against nails, beads, rice, macaroni, or other material.

A large block will be weighed against bolts, road metal, marbles, or other material.

The presentation of a wide variety of materials to weigh, as well as a variety of objects which can be used as units of measurement, allows the child to build up a power of discrimination through judging how he can conserve time and effort.

Just as children begin to realize the need for an appropriate unit with respect to length, so will they realize the value of an appropriate unit with respect to weight :

The lighter the unit the greater the precision that can be attained—a small block may be equal in weight to nine counters, but it is heavier than one bolt and lighter than two bolts.

An appropriate unit allows easier measurement—it is easier to find a bolt which weighs the same as five acorns than to have to count out a large number of rice grains as an equal weight.

A common unit is necessary when weights are to be compared—three different children may find that a block weighs twenty beads, ten marbles, or a jarful of macaroni. It is difficult for them to compare these differing results.

Outcomes

By the end of Section B the child should—

(*a*) appreciate the usefulness of the balance in comparing weights ;

(*b*) be able to use the balance accurately ;

(*c*) realize the need for an appropriate and a common unit of measurement ;

(*d*) have a better appreciation of equality and be able to demonstrate it more precisely ;

(*e*) be able to use, though not define, the properties of equality with regard to weighing ;

(*f*) have extended his vocabulary, and his understanding of it, beyond that of Section A.

SUGGESTED ACTIVITIES

Refer also to the notes on the suggested activities for length, Section B, pages 48 and 49.

Find in the room any three things of different weights.

Put them in order from heaviest to lightest.

Balance them with bolts. Were you right ?

★

Provide the materials named in the activity.

Guess first and then check :

- ☐ bottle tops balance six nails.
- ☐ counters balance six nails.
- ☐ stones balance six nails.
- ☐ acorns balance six nails.
- ☐ nuts balance six nails.

Did you need more counters or more stones to balance the six nails ?

★

Find in the room five things heavier than your reader.
Balance each one against your reader.
Were you right ?

★

Tip a cupful of sand into the balance pan.

Balance the sand with rice.

Add a matchbox to each side.

What happens ?

Add four beads to one pan.

How many beads do you think you need to balance the pans ? Add them. Were you right ?

★

Find two books that weigh the same.

Check them on the balance.

Find two pieces of chalk that weigh the same.

Check them on the balance.

Put one book in one pan, and the other book in the other pan.

Put one piece of chalk on one side and the other piece of chalk on the other side. What happens ?

Can you keep the pattern going ?

★

Provide a variety of materials, pairs of which match in weight (blocks, parcels, toys, bags, or packets of weighing material).

The children are asked to match the pairs that weigh the same, first by picking up the objects and estimating that they match in weight, and then by checking on the balance.

★

Provide the child with the objects named in the activity ; a balance ; and counters as units of weight.

Put a tick in the circle beside the name of the object you think is heavier in each pair :

○ a stick of chalk	☐	○ a pencil	☐
○ a stone	☐	○ a duster	☐
○ a toy car	☐	○ a book	☐
○ a doll's shoe	☐	○ a doll's jumper	☐

Weigh each object with counters.

Write your answer for each in the square.

★

Provide a box containing balls of various sizes.

Can you find—

a small ball heavier than a large ball ?

a large ball heavier than a small ball ?

two balls which weigh the same ?

two balls heavier than the biggest ball in the box ?

Weigh them. Were you right ?

★

Fill a jar with sand.

Put sand in each of these containers—

tin,
bottle,
packet,
bag,

until they each balance your jar of sand.

★

Can you find a small ball heavier than a large ball ?

Can you find anything in the room which is small and weighs more than some thing which is larger ?

Can you fill a small packet so that it weighs more than a large packet filled with some other material ?

★

Provide three tins, identical in size and shape, and a variety of materials for weighing.

Fill each tin with a different material.

Make the first tin weigh the most.

Make the third tin weigh the least.

Make sure each tin is full.

★

Provide a box of stones of various sizes and a variety of weighing materials.

Find the heaviest stone in the box.

Balance this stone with nails.

Balance these nails with bolts.

Balance the bolts with beads.

Balance the beads with the heaviest stone.

What happens ?

★

Put a duster and a cone on one pan of the balance.

They weigh as much as △ sticks of chalk.

They weigh as much as △ nails.

They weigh as much as △ blocks.

They weigh as much as △ gum nuts.

Did you use more sticks of chalk or more blocks ? Why ?

Did you use more nails or more gum nuts ? Why ?

★

Provide large beads of uniform size and a cup.

Fill the cup with large beads.

Share the beads between the two pans of the balance.

What happens ?

How many beads have you altogether ?

★

Find anywhere in the room pairs of things which you think match in weight.

Check them on the balance.

★

Put six sticks of chalk in one pan and six blocks in the other. Which weighed more ?

Put six nails in one pan and six gum nuts in the other. Which weighed more ?

Put one stick of chalk in one pan. Guess if it weighs more or less than one block. Check. Were you right ?

Put one gum nut in one pan. Guess whether it weighs more or less than one nail. Check. Were you right ?

SECTION B—TIME

NOTES

The work of Section B consolidates that of Section A and prepares the child to appreciate the hour as a measure of time in Section C.

The Clock

During this section the child becomes more aware of the clock as a measurer of time :

He hears his parents speak of time ;

he sees his teacher refer to her watch and the clock ;

he sees the clock which frequently appears on the screen before his television program.

Incidental discussion in the classroom centres on the clock. Children will begin to comment on the difference in the size of the hands and the position of the hands in relation to the figures on the clock-face. The teacher will be able to utilize such comments and the questions arising from them as a basis for much incidental teaching. The teacher herself can refer to the position of the hands from time to time :

"We will go out for a game when both hands of the clock are on twelve."

"The hands are nearly there" (perhaps at 11.45).

"Which hand has the furthest still to go ?"

Vocabulary

The child should be encouraged to extend his vocabulary and to use words that are within his understanding and that are more explicit than those used in Section A.

Words and phrases which are used more precisely could be : Now, later, soon, in a little while, today, last night, tomorrow morning, tomorrow.

Much of this vocabulary will be gained from hearing others use these words, but the teacher will be constantly looking for opportunities to check the child's understanding as the words are incorporated in everyday language.

There will be a growth in the child's ability to place routine events in chronological order, and this will be reflected in his incidental comments :

"I have to feed the goldfish before I go home."

"It's nearly lunch-time, and after that we have a telecast."

The daily diary and the weather chart will assist in making the names of the days more familiar to the child. Reference to the seasons will come through interest in nature. The words denoting the year

and the month will be used by the teacher, but passing references are enough. The word "year" can become part of the child's vocabulary although he does not understand it :

"Next year I'll be seven."

"This year we are in Grade I."

Duration

A number of activities should be introduced so that the child may gain some appreciation of the duration of time. Some ideas that he can discover are—

different people take different times to perform the same action ;

the same person takes different times to perform different actions.

Much of this work can be done through activities involving comparison :

"How many beads can you thread while John puts the clay into the bin ?"

"Mary will walk and Anne will run the length of the basketball court."

"Who took the longer time ?"

"Who took the shorter time ?"

"Why ?"

Discussion can help establish such ideas as :

"It takes longer to go to Grandma's place than it does to come to school."

"I get to school more quickly when Mummy brings me in the car than when I walk."

The teacher should realize that in this section the child is not expected to estimate length of time.

Outcomes

By the end of Section B the child should—

(*a*) appreciate the clock as a measurer of time ;

(*b*) be able to use a wider and more precise vocabulary than he did in Section A ;

(*c*) appreciate the idea of duration ;

(*d*) be able to place routine events in chronological order in conversation ;

(*e*) know the names of the days, not necessarily in sequence.

SECTION B—MONEY

NOTES

The Child's Background

As in Section A, the child will probably be limited in his experiences with money. Although the activities of the earlier section were planned to lead him to appreciate the buyer-seller relationship, he is prevented from gaining a true appreciation because of his immature ideas of value. It could also be that because of his home environment he does not observe or participate in the handling of money.

In certain family situations he will be allowed to "go messages" for his mother and he may also be given pocket money and gain his first ideas of "saving up". This could be reinforced by participation in a school banking system, though his ideas of this are not very clear.

Much of his experience with money will come not from classroom situations but from his environment away from the school.

The "Shop"

The classroom shop, although an artificial situation, continues to provide a focal point for the work on money in Section B.

When the child can recognize figures they should be used on the price tags. At first the figure represents the number of coins. Practice should then be given in the recognition of coins to ten cents. After this the figure may be used to represent the value of the coins to be tendered. As the child gains in experience and understanding he is able to replace a five-cent coin by five one-cent coins, and a ten-cent coin by ten one-cent coins.

The children continue to buy one article at a time to avoid addition situations, and they tender the correct price so that no change is involved.

Coin Recognition

This is often a carry-over from the child's environment, and in the introductory stages at school real money should be used. The coins are introduced in any order, for recognition only. Discussion on the equivalent values of the coins will lead the child to recognize that, for example, a five-cent coin has greater value than a two-cent coin, or that two one-cent coins have the same value as one two-cent coin. The child learns to appreciate the convenience of the coins of larger denomination and is able to choose the coins he needs when shopping.

Practice in recognizing coins can be encouraged through activities related to the classroom shop :

The shopkeeper sorts his coins into like piles ;

monitors share out money to be put into customers' purses to begin shopping games ;

customers make up sets of coins in order to buy goods.

Value

It is difficult for the child to appreciate the idea of value or worth. The teacher's approach can only be through discussion and, whenever an opportunity arises, advantage should be taken to gain some understanding. In such a complex issue teachers should present some aspect in simple terms that the child can understand :

> A car costs lots of money because many men are needed to make it and there are lots of parts to it.

Understanding of value is one aspect of the work which can only develop as the child matures and gains experience in handling money itself. Thus it is a continuing topic throughout the course.

Outcomes

By the end of Section B the child should—

(*a*) be able to recognize coins up to ten cents ;

(*b*) know the values of coins up to ten cents in terms of one-cent coins ;

(*c*) have some ideas of the different values of various articles, and that some things cost more than others.

SECTION B—SPATIAL RELATIONS

NOTES

In this section the child is given further opportunities to—

(i) enlarge his vocabulary ;

(ii) learn more about his environment in terms of position ;

(iii) investigate shapes.

Environment

Much of the work in spatial relations is concerned with vocabulary because the child is attempting to describe the location of specific objects. Many opportunities to develop ideas arise both inside the classroom and in the school-ground, particularly where such equipment as climbing bars, " jungle gyms ", and the like are provided.

A consciousness of his position in relation to his environment provides the motivation to describe location, and the terms " right " and " left " are used to a greater extent.

A development of vocabulary will be seen, for example, in relation to the question : " Where are the jigsaw puzzles kept ? "

" Over there " (assisted by a pointing finger).

" On the shelf."

" On the top shelf."

" On the top shelf of the cupboard."

" On the top shelf of the cupboard near the door."

As the child becomes more aware of the classroom environment in terms of finding materials and describing location, so he should gain experience in finding out about the school environment in general, and further work should be undertaken to let him both discover and describe movement within these bounds :

" The slide is near the see-saw."

" The slide is between the see-saw and the big gum-tree."

" I can walk to the shelter shed if I go along the path beside our room. But if I go out that door, I will have to walk along the path beside Miss White's room."

Shapes

Consolidation of the work in Section A in relation to simple shapes will continue, and this work can be extended :

(i) By increasing the range of shapes to be recognized. Oval, oblong, and diamond should be added to the shapes used in matching ; irregular shapes may be introduced into both discussion and activities.

(ii) By using known shapes to construct further shapes through creative and informal work. The child is provided with

shapes and allowed first to use them freely and then to identify his final product :

Circles and rectangles may be used to make a " man " ;

cubes and pyramids could be used to make " houses ".

It is important that the children be supplied with sets of shapes which are related in size so that new and larger shapes may be built up. Smaller shapes from these sets may also be used to cover larger ones.

(iii) By the recognition of shapes in everyday objects :

" How many things can you find that look like a circle ? "

" How many triangles can you see in the room ? "

Shapes such as those found in the shadows of trees and objects ; patterns in materials, tiles, and jigsaws ; and many of the common things which surround the child each day should be used as focal points for discovery and discussion.

(iv) By the recognition of shapes in pictures. Pictures from magazines or collected from various sources may be mounted on card and covered with plastic. The children can be asked to draw around things seen in the picture similar to a nominated shape, using chinagraph pencil or oil pastel.

Many of the activities associated with free play lead to the use of shapes in building and pattern making, and opportunities should be provided, as in Section A, for the children to create shapes of their own using scissors, coloured paper, and other materials.

For the adult the concept of shape may refer to a boundary or a surface ; a " circle " may be regarded as a ring or a disc, depending upon the situation. The distinction between surface and boundary is too difficult for Section B level, and teachers should be careful not to ask the child to define formally the shapes he is using or discussing. Broad generalizations and comparisons are of value :

A triangle has corners ;

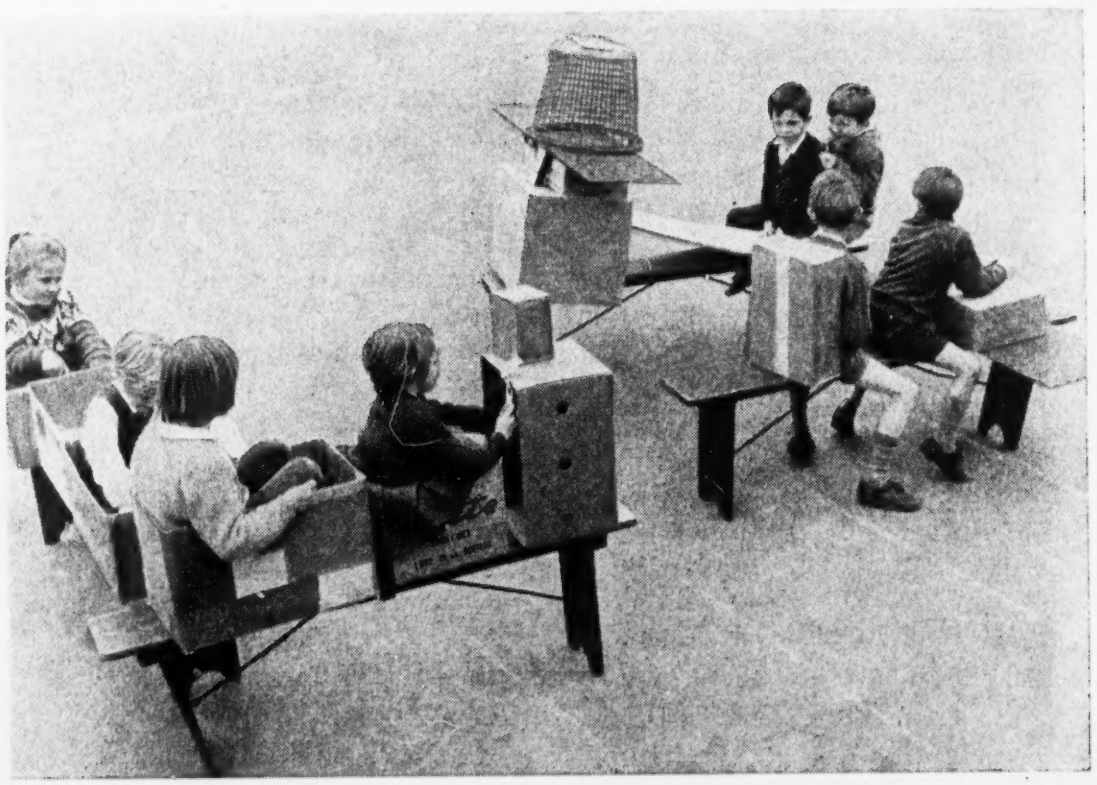
a square or a rectangle has corners ;

a circle is round.

Creative Construction

Throughout the whole of this section, creative construction continues to play a large part in the development in the child of an awareness of space and shape.

It is possible in Section B to enlarge the range of constructional materials because of the child's growth in manual dexterity. But children should not be confined to making small models from sets of building blocks. They should be encouraged to use whatever large material (such as blocks, chairs, tables, and forms) is available. They are then able to make models in which they can play, and so add to the enjoyment and the value of the topic.



Outcomes

By the end of Section B the child should—

(*a*) have increased his vocabulary and his understanding of it, and be able to describe position, using at least two reference points :

The chair *near* the table *in the middle of the room.*

(*b*) be able to follow directions involving the vocabulary of position ;

(*c*) be able to find his way around the school environment ;

(*d*) be able to match a variety of shapes and also see some of these in his environment.

SUGGESTED ACTIVITIES

Refer also to the notes on the suggested activities for length, Section B, pages 48 and 49.

Provide a selection of pre-cut shapes or allow the children to cut their own.

Make as many new shapes from these as you can.

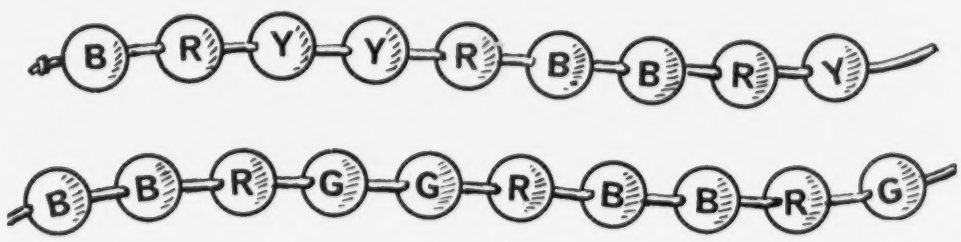
How many different shapes did you use ?

How many different new shapes did you make ?

★

Provide beads threaded on a string showing an established pattern and ask the child to continue the pattern.

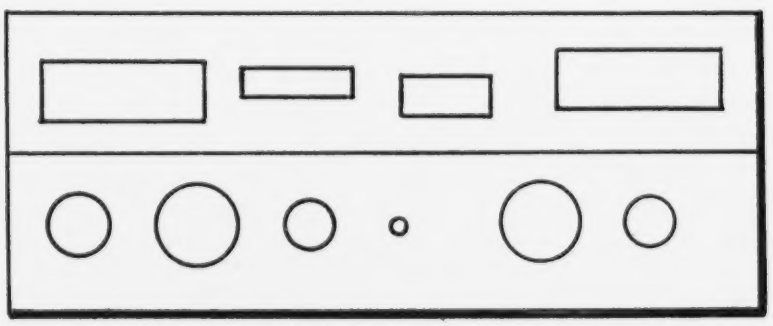
The number of beads in each repeat of the pattern may be varied to provide degrees of difficulty.



★

Provide prepared cards as shown. The children are asked to mark in each line the shapes that are of the same size.

Shapes may be referred to by name : " Mark the circles (triangles, rectangles, etc.) that are of the same size."

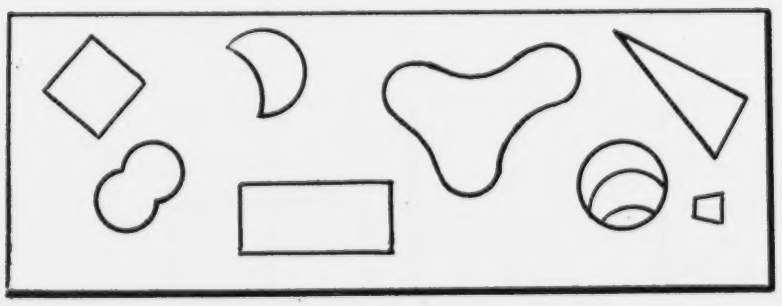


★

Provide cards with instructions :

Colour in red the shapes with straight lines.

Colour in blue the shapes with curved lines.



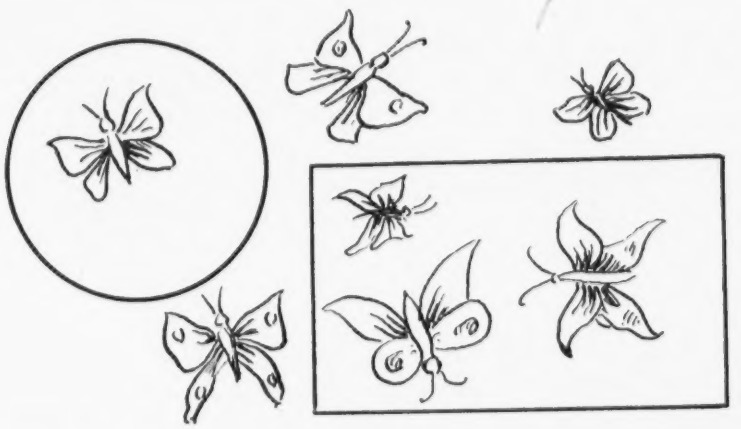
★

Prepared cards (as shown) may be used for the following activities :

How many butterflies are inside the oblong ?

How many butterflies are inside the circle ?

How many butterflies are outside the oblong and the circle ?

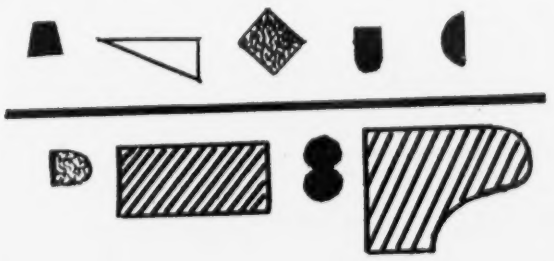


★

There are ☐ shapes above the line.

There are ☐ shapes below the line.

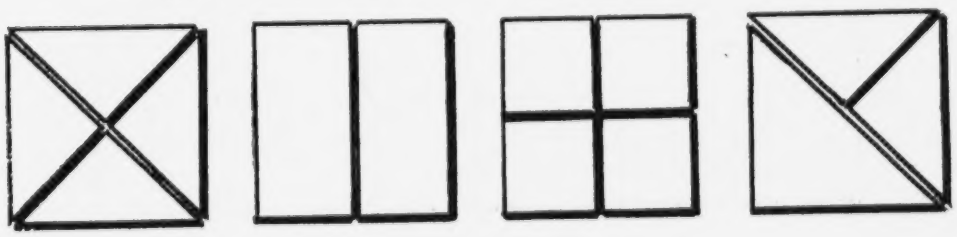
There are ☐ shapes altogether.



★

From a fraction kit provide shapes that will make up into a basic square.

How many different ways can you use these shapes to make a square ?



★

Prepared cards or concrete objects may be used for the following activity :

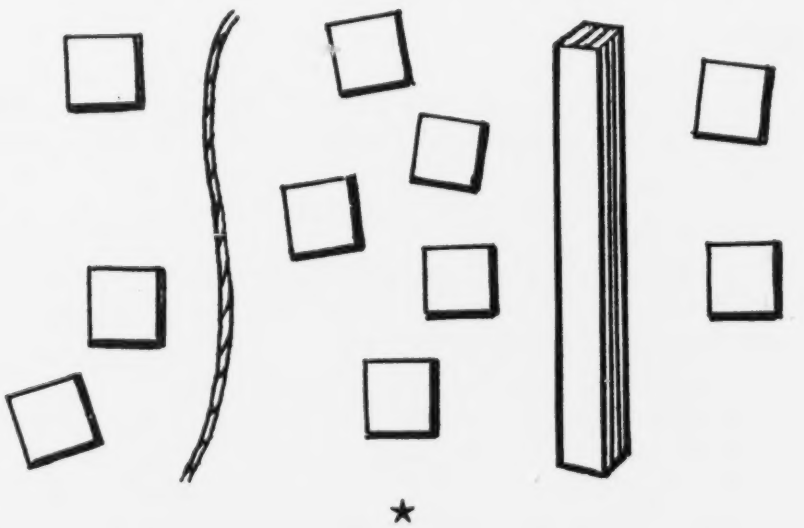
There are ◯ counters between the rod and the string.

There are ◯ counters to the right of the rod.

There are ◯ counters to the left of the rod.

There are ◯ counters to the left of the string.

There are ◯ counters altogether.



★

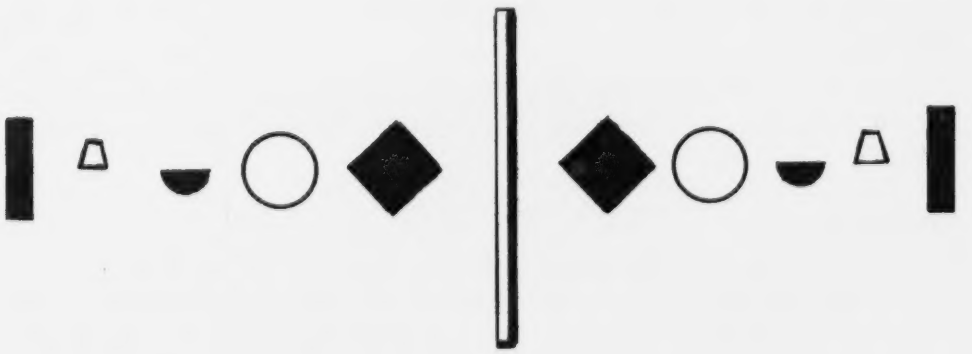
Two children sit beside each other. They are provided with an assortment of shapes. A plastic stick is placed on the table or on the floor between the children to act as marker.

Child A selects and places a shape to the left of the marker.

Child B matches this shape and places this to the right of the marker. He then selects and places a new shape to the right.

Child A matches this, places his selection, and then chooses a further shape.

The children continue in turn and so build up a pattern :



SECTION C

INTRODUCTION

Aims

In previous sections, the foundation for an appreciation of measurement has been laid, the child has been introduced to the idea that units of measurement are needed, and he has been given the opportunity to learn to measure accurately.

In Section C, the child is able to consolidate his ideas of comparison and of the importance of appropriate and common units. At the same time he will be led to see that, as a basis for communication, formal or standard units of measurement are necessary—the foot, the pint, and the pound.

The Standard Unit

It is not difficult for the teacher to create situations which will lead the child to see that a break-down in communication occurs when individuals or groups do not use a standard unit of measurement :

Child A is supplied with two-inch plastic sticks and Child B with six-inch plastic sticks. Each child is given a three-foot length of streamer which he is asked to measure with the sticks provided. Comparison of answers and the confirmation that both lengths of streamer are the same give a basis for discussion as to why the answers differed.

Similar situations may be set up with groups of children measuring weight and capacity.

If the co-operation of a teacher in an adjoining room can be obtained, a situation may be dramatized by sending messages or directions for construction from one class to the other using such vague units as " sticks ", " tinfuls ", or " blocks ", and then comparing the results.

The important aspect to be considered in this section is that standard units are necessary to provide a means of communication. Inter-class activities emphasize the weakness of communication when results from each grade of the same operation do not correspond. Once the unit is defined as the foot, the pound, or the pint, results will match.

Later sections will deal with the convenience of standard units of measurement and the fact that it may be more convenient to measure in larger or in smaller units.

Measurement

It can be appreciated that, with the introduction of the standard unit, measurement will not be confined to whole numbers of these units. Informal units will still play an important part in the child's

measuring activities, and results will often be a combination of standard units and informal units :

"This bottle holds one pint and one cupful of water."

"My tin of rice weighs one pound and one block."

The child may also express lengths solely in terms of body units or other informal units :

"My book is as wide as my hand."

"This block is as long as my foot."

Through this type of activity the child begins to realize the need for smaller units, and thus will be led into the work of later sections.

Dividing and Combining Materials

Teachers should continue to provide activities which will give the child opportunities to measure, divide, combine, and compare with the original amount of material used. Reference should be made to the discussion under the above heading to be found in the introduction to Section B.

It can be appreciated that the child will need to develop manual dexterity in order to handle his material efficiently and accurately.

Estimation

Whenever possible the child should be given the opportunity to estimate his likely result and to check by measurement. This is a developing skill, and with experience the child should become more confident and estimate more correctly.

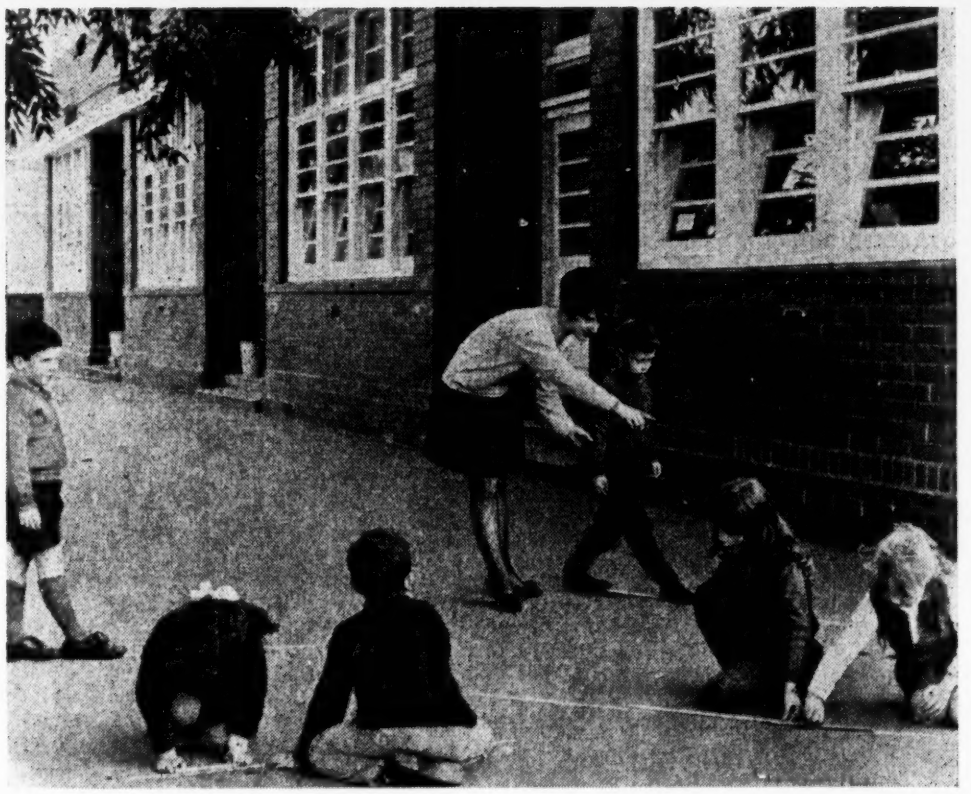
SECTION C—LENGTH

NOTES

The Standard Unit—The Foot

The child will have used sticks one foot in length throughout his work on measurement, although the length has not been defined. He may have heard of such a unit of measurement in his home environment and may even have seen it used while watching an older brother or sister or an adult working. The origin of the unit may prove an interesting theme for story time, and the child can use his own foot as a unit of measurement.

Activities, as discussed in the introduction to Section C, provide a basis for the child to understand the need for standards of measurement, and once this has been established many activities using the foot should be carried out. Rulers are not necessary in Section C, and a stick one foot long can be used for all the activities the child will undertake.



Comparison and Measurement

Because of his experience in earlier sections, the child is able to combine his standard and his informal units with a fair degree of accuracy. When he has to measure a length which is in excess of a number of standard units he should be encouraged to use a minimum of informal units. This acts as further practice in estimation, although results can be stated in a wide range of units :

"My table is three feet and a bit long."

"My table is three feet and three nails long."

"My table is three feet and a milk straw long."

Because the child's range of counting numbers has extended and his unit of measurement has become the foot, he is able to measure longer lengths :

How long is the chalkboard ?

How wide is the room ?

Put three tables end to end and then measure to find the total length.

Introduction of a standard unit of measurement is not meant to imply rejection of appropriate informal units. By using the informal unit the child is able to gain a better understanding of the appropriate standard unit.

It is important that the teacher should continue to encourage the child to estimate his answers and then check by measuring, as discussed in the introduction to Section B.

Interest Centres

The teacher should endeavour to stimulate an interest in the measurement of length, and a section of the display board or a corner of the room can be utilized to display news items about length :

Information about the child's environment—

"Our room is twelve of Tom's strides long."

"It is six feet from our door to the door in the corridor."

"We cut some cord as long as the library. The shelter shed is as long as six pieces of the cord."

Graphs of children's heights, with comments added—

"Mary, Stuart, and Betty are each more than three feet tall."

Items concerning achievements—

"Peter jumped three feet along the path."

Blocks

Blocks of various shapes and sizes should still be used for building as well as for units of measurement. It is not possible to limit the child to using blocks merely as units of measurement for length ; it is possible to see from the activities discussed below that many aspects of applied number merge when blocks are used.

One-inch wooden cubes are a suitable material for packing exercises, which still continue. The blocks are also valuable for measuring length and can be effectively used in Section D, when emphasis is placed upon the need for a smaller unit of one inch.

Blocks may be used in activities—

for measuring length : "This locker is two feet and four blocks wide."

for packing : "I can fill this box with eighteen blocks."

for area ideas : "It takes twenty blocks to cover this piece of cardboard."

While carrying out these activities, the child is able to appreciate that various constructions can be made from the same number of blocks, and he begins to gain incidental experience which will lead to understanding the work in volume in later sections.

Outcomes

By the end of Section C the child should—

(*a*) have gained an understanding of the idea of a standard unit ;

(*b*) be able to estimate, and check this estimate, using any informal or body units he chooses, in particular, his foot ;

(*c*) be able to estimate and order lengths as being larger or smaller than the standard, the foot ;

(*d*) be able to appreciate some length measurements in his environment, particularly outside the confines of the classroom and the mathematics period ;

(*e*) have established, and be able to use, a wider and more varied vocabulary than that of Sections A and B.

SUGGESTED ACTIVITIES

Notes

(i) These activities are suggestions only and are not presented in any sequence of development.

(ii) They may be used as a basis for—

(*a*) oral directions ;

(*b*) the preparation of assignment cards, which must be related to the reading ability of the child ;

(*c*) adaptation to provide easier or more difficult activities ;

(*d*) a series of graded exercises.

(iii) Recording of results should be brief, but teachers are reminded that full evaluation is only possible if the teacher takes the opportunity to discuss with the child the work he has carried out.

Activities

Provide strips of plastic, lino, masonite, three-ply, and other fairly rigid materials ; strips to be of different lengths ranging from one to eleven inches.

Sort these strips into pairs so that each pair, when put end to end, measures one foot.

★

Provide an assortment of strips of rigid material as suggested above, including some lengths up to twenty inches. This material is preferable to cord, ribbon, and the like, which has a tendency to twist and curl.

Sort this material into three groups :

First group—lengths that are more than one foot.

Second group—lengths that are less than one foot.

Third group—lengths of one foot.

★

Cut five pieces of streamer each one foot long. Paste these pieces on paper so that they make interesting shapes.

Cut some pieces of streamer less than one foot long and add them to your work.

★

Find something which is one foot long and use it to fill in the gaps below :

☐ counters are as long as one foot.

☐ short plastic sticks are as long as one foot.

☐ long plastic sticks are as long as one foot.

☐ middle-sized plastic sticks are as long as one foot.

★

Find three things you think are each longer than one foot. Measure them. Were you right ?

Now find three things almost exactly one foot long. Measure these.

★

Find a box a little more than one foot long. Find six things long enough to fit in the box.

How long do you think each thing is ? Measure. Were you right ?

★

Work with a partner. Use a matchbox to measure with while your partner uses a clag brush.

The length of the table is ◯ matchboxes.

The length of the table is △ clag brushes.

Why do you think the answers are different ?

The length of the window-sill is ◯ matchboxes.

The length of the window-sill is △ clag brushes.

Why do you think the answers are different ?

The length of the library is ◯ matchboxes.

The length of the library is △ clag brushes.

Why do you think the answers are different ?

The length of the blackboard ruler is ◯ matchboxes.

The length of the blackboard ruler is △ clag brushes.

Why do you think the answers are different ?

★

Provide a stick of chalk and a length of wood about two feet long.

Would the piece of wood or the stick of chalk be easier to use to measure the things below ?

Guess first and write W for wood or C for chalk against each one, then measure to see if your guess was right.

- ☐ The length of the room.
- ☐ The chalkboard duster.
- ☐ The teacher's table.
- ☐ The length of the big cupboard.

Why was it easier to use the stick of chalk for some things and the piece of wood for others ?

★

Cut some streamers to be the same length as—

one foot of tape ;

a foot ruler ;

a stick one foot long ;

a piece of string one foot long.

Paste the streamers on paper side by side.

What do you notice about their length ?

★

This stick is three feet long.

Find four children in the grade who are more than three feet tall. Measure them. Were you right ?

Find two children in the grade who are less than three feet tall. Measure them. Were you right ?

★

Provide three sticks as described below, ranging in length from nine inches to two feet.

Find two measuring things which will give you different answers when you measure—

the long blue stick ;
the short green stick ;
the long yellow stick.

Are your answers different ?

★

Provide a bundle of plastic sticks and some strips of plastic lacing or string.

Make a house from—

4 long plastic sticks,
5 middle-sized plastic sticks,
3 small plastic sticks,
and plastic strips of different lengths.

Cover up your house.

Give this card to your partner so that he can make the house.

When it is finished look at both houses and tell why they are different.

★

Use a one-foot ruler.

Write your guesses in the circles, then measure and write your answers in the squares :

- ○ counters fit along the ruler. □
- ○ beads fit along the ruler. □
- ○ sticks of chalk fit along the ruler. □
- ○ short plastic sticks fit along the ruler. □

★

Use a one-foot length of wood as your measure.

Write your guess in the circle.

Measure, and write your answer in the square.

GUESS	MEASURE
○ The length of five cupboards.	□
○ The length of the drinking-tap trough.	□
○ The length of the display board.	□
○ The length of three tables pushed together.	□

SECTION C—VOLUME AND CAPACITY

NOTES

The Standard Unit—The Pint

The introduction of the standard unit of capacity may follow the methods discussed in the introduction to Section C and the notes on Length. Situations may be contrived within the classroom where the need for a standard unit can be seen and appreciated.

Once the pint has been introduced, the child should be given many opportunities to use this unit, and work on estimation should be closely linked with these activities.

Informal units will still be used, and the child may express capacity in a number of different units :

"My bucket holds two pints and a bit over."

"My bucket holds two pints and a cupful."

Packing

Packing continues to be the basis for a number of activities, and in Section C the child should be able to select appropriate containers for the articles he is asked to pack :

A box long enough to contain the sticks the child is asked to pack, so that they lie flat or stand upright and economically fill the space.

A box large enough to allow blocks to be packed in layers without wasting space.

Ideas of capacity may be strengthened when the child is asked to pack two containers of similar size, each with blocks of different sizes :

Guess how many blocks will fit into this box.

Pack the blocks in and find out if your guess was right.

Empty the box, then guess how many small blocks you think it will hold.

Check and see if you were right.

Did you use more of the large blocks or more of the small blocks ?

Outcomes

By the end of Section C the child should—

(*a*) have gained an understanding of the idea of a standard unit of capacity and have used the pint as such a measure ;

(*b*) be able to estimate "more than" or "less than" one pint ;

(*c*) have some experience in packing, and some discrimination in the selection of a container appropriate to the material being packed ;

(*d*) be able to use a wider vocabulary and with more precision than in Sections A and B.

SUGGESTED ACTIVITIES

Refer also to the notes on the suggested activities for length, Section C, page 76.

Provide containers as listed, a one-pint measure, and water.

How many pints does each of these containers hold :

The jug ; the kettle ;
the biggest jar ; the beach bucket ?

Guess, then measure.

Put them in order from the largest to the smallest.

★

Use a school milk bottle as a measure.

Guess first and then measure to see if you were correct.

How many school milk bottles full of water would fill a pint jug ?

How many would fill the beach bucket ?

How many would fill the big jug ?

★

Find three containers which look different from one another, but which will hold one pint each.

★

Provide a varied selection of containers.

Sort these containers into those you think hold more than a pint and those you think hold less than a pint.

Now measure and see if you were right.

★

Look at these containers and choose three which you think hold more than one pint each.

Now choose two containers which you think hold less than a pint each.

Can you choose a container which holds only one pint ?

Make sure the containers are of different shapes.

Measure and see if your guesses were correct.

★

How many pints will fill—

the small green bucket ?
the big red dish ?
the yellow jug ?
the blue beach bucket ?

Guess first and then measure.

★

Measure a pint of water into a jug.

Pour this water into two mugs.

Pour the water from one mug into the jug.

Pour the water from the other mug into the jug.

How much water do you think is in the jug ?

Guess first, and then measure to see if you were right.

★

Provide a one-pint measure and containers as listed. The children may fill the gaps as suggested or they may be asked to prepare sentences of their own.

Fill the gaps :

With one pint of water I can fill—

△ cups ;
△ jars ;
△ glasses ;
△ bowls.

★

Use **one** pint of water to **fill** three different containers.

★

Pour a pint of water into the kettle.
Pour the water from the kettle into the jug.
Pour the water from the jug into the beach bucket.
Guess how much water there is in the beach bucket.
Now measure the amount of water. Was your guess correct ?

★

Pour a pint of water into this jar.
Mark where the water level comes.
Tip the water into a dish.
Now fill the jar up to the mark you made.
Now write a sentence to tell how much water you think is in the jar.
Measure and see if you were correct.

★

Fill the gaps with whichever of these words you think will make a true sentence :

" more than "
" less than "
" the same as "

3 cups hold ☐ 2 glasses.
2 cups hold ☐ the jug.
6 lids full hold ☐ two jars full.
4 tablespoons hold ☐ one glass.

Now measure and see if you were correct.

★

Find three boxes which you think will hold more than seven, but less than twelve, matchboxes.

Now fill them with matchboxes.
Was your guess correct ?

★

Make a roll of dough. Weigh the dough.

Flatten out the dough and cut it into biscuit shapes with the lid of a tin.

Weigh the biscuits and the bits of dough left over.

What do you find ?

★

Guess first and then measure :

How many pints does the jug hold ?
How many jugfuls fill the bucket ?
How many pints fill the bucket ?

SECTION C—WEIGHT

NOTES

Convenient Weights

Variety of material provides the child with the opportunity to gain a wide range of experiences to help him to develop the concept of weight. One of the aspects he comes to appreciate is that different amounts of material may be needed to attain balance :

A small number of pebbles may balance a large amount of sawdust ;

a tin full of rice may be balanced by one or two lead sinkers ;

a cupful of wheat may balance less than a cupful of sand ;

a used torch battery may balance a large amount of cotton wool.

Without knowing it, the child is gaining experience and absorbing ideas upon which he will be able to draw later in life when he begins work on density. But also from these experiences comes the idea of a convenient weight, easier to handle than the bulky materials he has been working with in the past.

Many of the child's activities in earlier sections of his work will have centred on measuring one thing against a number of things, and these experiences will reinforce the idea of convenience.

Standard Weight—The Pound

The introduction of a standard unit of measurement has been discussed in the introduction to Section C and also in the notes on Length. (See pages 72 and 73.)

Situations similar to those discussed in relation to length, centering on the communication of concepts of certain weights, can be readily contrived between children, groups, or neighbouring grades, so that the idea of a standard weight arises.

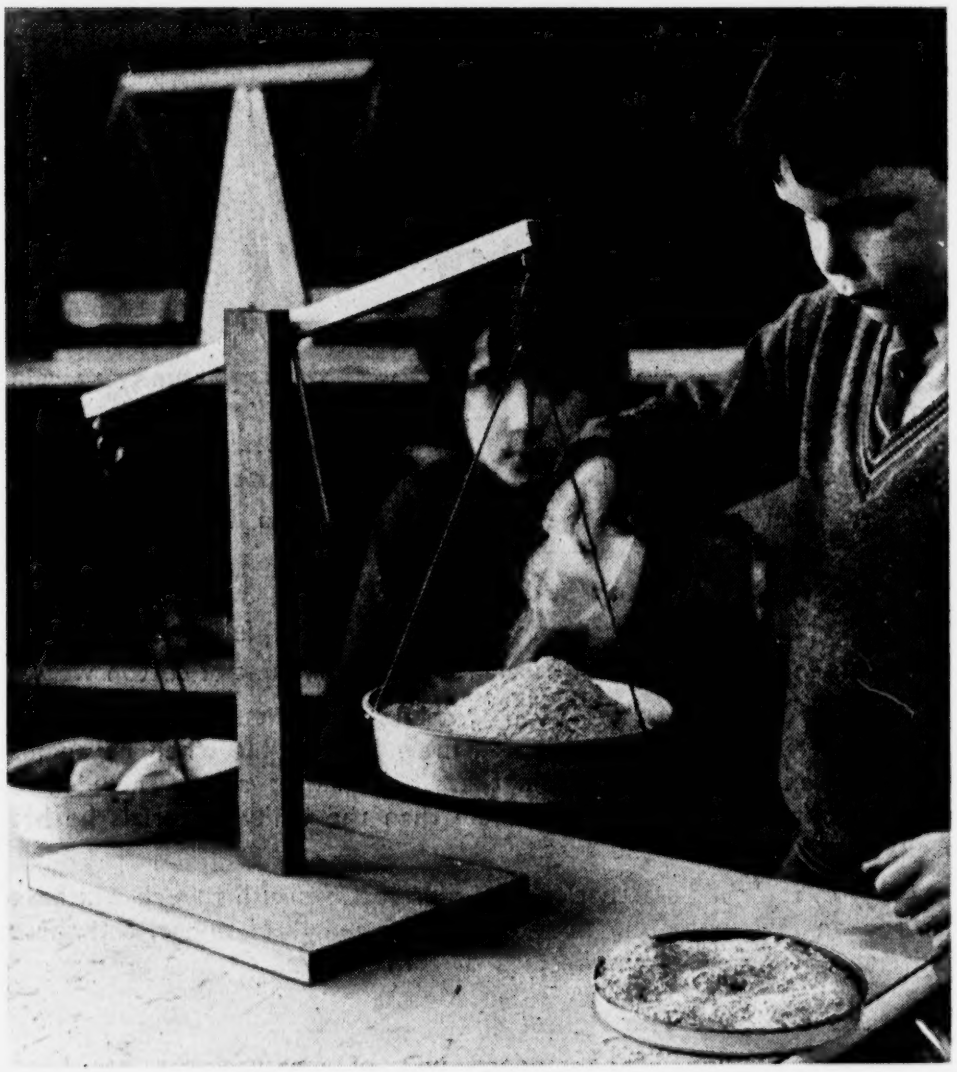
The pound, as a word and perhaps as a unit, will be known to the child who has gone shopping with his mother and has heard her ask for "a pound of . . . " or " pounds of . . . ". It must be remembered, however, that the child may not have had much conscious experience in handling this weight because of the variety of packaging at present available or the fact that his mother buys parts or multiples of a pound.

The use of the pound should be discussed by the teacher with the children, and one-pound packages should be added to the classroom shop. The child then has opportunities to practise weighing this amount prior to being asked to measure out specific amounts.

Before using or being introduced to the pound weight, the child should have had much experience in weighing against one object on one side of the balance :

How many small blocks balance this large block ?

How many marbles will balance this book ?



Application

An important part of the work with the pound is to lead the child to see that he does not need to work only with a formal weight, but that, having used this once, the pound of material he has weighed may become his weight should he need an equivalent amount.

Wherever possible, the child should discover this, and activities can be planned to this end :

Use the one-pound weight to weigh a pound of sand.

Use your pound of sand to weigh a pound of rice.

Put your rice on one pan and the pound weight on the other pan.

What happens to the scales ? Why ?

It is doubtful whether children in Section C really appreciate these ideas fully. Activities of this type can begin in Section C, so that understanding can be reached in Section D.

Teachers must take care to see that the weighing in these activities is accurate and that fine materials such as sand, sawdust, and grains are used in preference to road metal, large beans, and coarser materials. With accurate weighing it is possible to compare quantities weighed by one group with those weighed by another, and so establish equivalence.

Shopping activities may now be enlarged, to allow the children to "buy" pounds of different materials, and to add variety to the stock of the classroom shop.

Much practice in weighing a pound will lead to greater accuracy in estimation and, as discussed in the notes on Length (page 74), results can still be expressed using a variety of units :

"This sand weighs a bit more than a pound."

"This sand weighs one pound and three blocks."

"This sand weighs one pound and one large block."

Informal units will still be used, especially if a child does not have a one-pound weight or if he is weighing something less than one pound.

Outcomes

By the end of Section C the child should—

(*a*) have gained an understanding of the idea of a standard unit of measurement of weight ;

(*b*) be able to estimate "more than" or "less than" one pound ;

(*c*) be able to estimate and check his estimation, using both the standard unit of one pound and informal units ;

(*d*) have established and be able to use a wider and more varied vocabulary than that of the previous sections.

SUGGESTED ACTIVITIES

Refer also to the notes on the suggested activities for length, Section C, page 76.

Provide tins of sand, shells, buttons, cotton-reels, plastic bags, and a scoop.

Put into each bag what you think will be one pound of each of these materials.

Check them on the balance.

Were you right ?

★

Provide a one-pound weight, plastic bags, and the materials suggested.

Weigh one pound of rice.

Use it to guess—

one pound of beads ;
one pound of bottle tops ;
one pound of sawdust.

Now check your answers on the balance.

Were you right ?

★

Provide a one-pound weight, plastic bags, a cup, and the materials suggested.

Weigh one pound of nails.

How many cupfuls of rice do you think will balance this ?

How many cupfuls of macaroni do you think will balance the nails ?

How many cupfuls of sawdust do you think will balance the nails ?

Check on the balance.

Were you right ?

★

Find a one-pound weight.

Find three things which you guess would together weigh a little more than your one-pound weight.

Now measure. Were you right ?

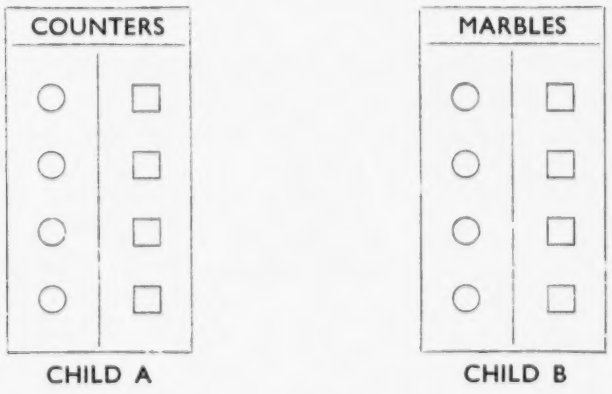
★

Work with a partner. One of you may use counters to weigh with, the other may use marbles. Write your guess in the circle, then measure and write the answer in the square.

Weigh these—

a duster,
five pencils,
two slippers,
a small reader.

Are the marbles or the counters the easier to weigh with ?
Why ?



★

Weigh out one pound of dry sand.
Weigh out one pound of wet sand.
Put them together. How much do they weigh ?

★

Provide tins of the same size and the materials as suggested.

Use these tins and the materials so that you can complete these sentences by using the words

"more than",
"less than",
or "the same as"

to fill the gaps below :

A tin of pebbles weighs ☐ a tin of beads.

A tin of plastic sticks weighs ☐ a tin of sand.

A tin of plastic foam weighs ☐ a tin of beans.

Guess first, then measure.

★

Provide prepared cards and the materials listed.

Guess first and put a tick in the circle beside the name of the thing you think weighs more in each pair.

Then check, using the balance, and put a tick in the square beside the name of the thing that weighs more in each pair.

○ The box of chalk ☐	○ A one-pound weight ☐
○ A one-pound weight ☐	○ Five dusters ☐
○ A one-pound weight ☐	○ One lunch box ☐
○ Two jars of clag ☐	○ A one-pound weight ☐

○ Seven pairs of scissors ☐

○ A one-pound weight ☐

★

Weigh out a pound of clay. Make a man from it.
Push the clay into a ball. Weigh the clay.
Make five apples from the clay.
Push the clay into a ball. Weigh it.
Use all the clay to make something from a long coil.
Push the clay into a ball. Weigh it.
How much did the clay weigh ?

★

Provide four jars of the same size and shape and the materials as listed.

Weigh out one pound of beans. Tip the beans into a jar.
Weigh out one pound of flour. Tip the flour into a jar.
Weigh out one pound of sand. Tip the sand into a jar.
Weigh out one pound of beans. Tip the beans into a jar.
Put the jars in order from the one that is fullest to the one that is least full.

★

Find a one-pound weight.
Balance this weight with Lima beans.
Balance the Lima beans with acorns.
Balance the acorns with road metal.
Take the acorns off the balance and put the one-pound weight in their place.
What did you find ?

★

Weigh out one pound of wet sand. Make interesting shapes from it.

★

Pour a pound of rice into one pan of the balance.
Pour beads into the other side until the pans balance.
Guess how much the beads weigh.
Weigh them. Were you right ?

★

Provide a variety of articles of different weights, a one-pound weight, and bags of materials of different weights.

Work with a partner.
Take turns to choose something from the table.
Balance this in your hand against the one-pound weight.
Say whether it weighs—
more than a pound,
less than a pound, or
the same as a pound.
Measure to see if you are right.

★

Put a pound of sawdust in a plastic bag.
Put a pound of stones in a plastic bag.
Put a pound of plastic sticks in a plastic bag.
Guess which of these weighs the most.
Check with the balance. Were you right ?

SECTION C—TIME

NOTES

Vocabulary and Understanding

A continuing problem for the teacher is the evaluation of the child's understanding of the vocabulary he uses. When dealing with length, weight, and capacity, situations may be set up so that the child, in handling concrete materials, provides clues to his depth of understanding through language usage. But when dealing with time this problem of evaluation becomes greater.

Because of the abstract nature of time, the child can gain his understanding only through experience. The teacher must therefore encourage the child to link events and vocabulary so that he can relate these over a " time span ". In earlier sections it has been suggested that the child should be able to appreciate the span from " yesterday " to " tomorrow ". This understanding can be extended in Section C and many words added to the child's vocabulary.

Duration, Sequence, Continuity

Over the span of his school-life the child will be led to develop some understanding of three aspects of time :

Duration—when a period of time is isolated and, as it were, inspected. Activities such as watching sand in an egg-timer or, at a later stage, estimating one minute to illustrate this aspect.

Sequence—the idea that one event follows another, that there is a chronological order of events.

Continuity—that time is a connected series of events; as one event finishes so another commences; that time extends into the past and will extend into the future.

It can be appreciated that any depth of understanding will not be attained until much later in life than the primary school period, but the first steps towards this understanding should be encouraged whenever opportunity arises.

Duration, implied in such questions as " How long does it take . . . ? " or " Which takes longer . . . ? " may become the focus of a wide range of activities. Timing devices, as suggested in the materials and equipment list (page 91), are important aids. Parallel with the use of these can go activities where the child compares performances, as suggested in the notes on Time in Section B (page 63).

Ideas of sequence will evolve from the need to describe events and activities :

> " Bruce put three blocks on the balance and *then* added one more. *When* he added another block the balance was level."
>
> " We were playing in the school-ground. *Then* we went for a nature walk and *afterwards* we came back for reading."

As the teacher employs words in her vocabulary, so will the child add them to his own stock. By being conscious of her use of words and ready to explain them so that the child will understand them, the teacher can carry out a great deal of incidental teaching.

It is often convenient for the adult to consider time in terms of a series of events, though still appreciating the fact that time is continuous.

The child's day provides an example of this synthesis, for it becomes for him the linking of periods of time :

Getting up and preparing for school ;

arriving at school and participating in classroom activities, which themselves are sectioned off by the school bell and by their variety ;

going home and the after-school activities leading up to bedtime.

When the child matures sufficiently, he will not merely see the day as the fusion of a series of events or as an isolated unit, but he will become aware that there is a continuity extending beyond the bounds of a day, a week, or an even longer period. It is in Section C that the child begins to develop this awareness.

The Clock

The child should come to see the clock as an indicator of significant times of the day. This attitude can be fostered by the teacher by reference to the positions of the hands, so that the child comes to observe—

(i) the movement of the small hand ;

(ii) the small hand as the marker of the hour ;

(iii) the position of the large hand at twelve, precisely on the hour ;

(iv) the movement of one hand in relation to the other.

A further point, which should be explained by the teacher, is that the term " o'clock " is a shortening of the phrase " of the clock ".

For many teachers, and other adults, the fact that the child can tell the time signifies that he " understands time ". It should be appreciated that the conventional clock is but one form of indicator and the child has only demonstrated that he can read this ; in other words, he can use an accepted vocabulary form to describe the position of the hands. Thus it is not correct to infer anything more than this from the child's performance.

The Days

It is in Section C that the child learns the names of the days in sequence and that there are seven days in one week. The weather chart and the diary or experience book are used as focal points here, and charts, which the children assist in making and which extend over a period of one month, can be valuable aids.

Outcomes

By the end of Section C the child should be able to—

(*a*) name the days of the week in sequence and know that there are seven days in one week ;

(*b*) tell the time in hours.

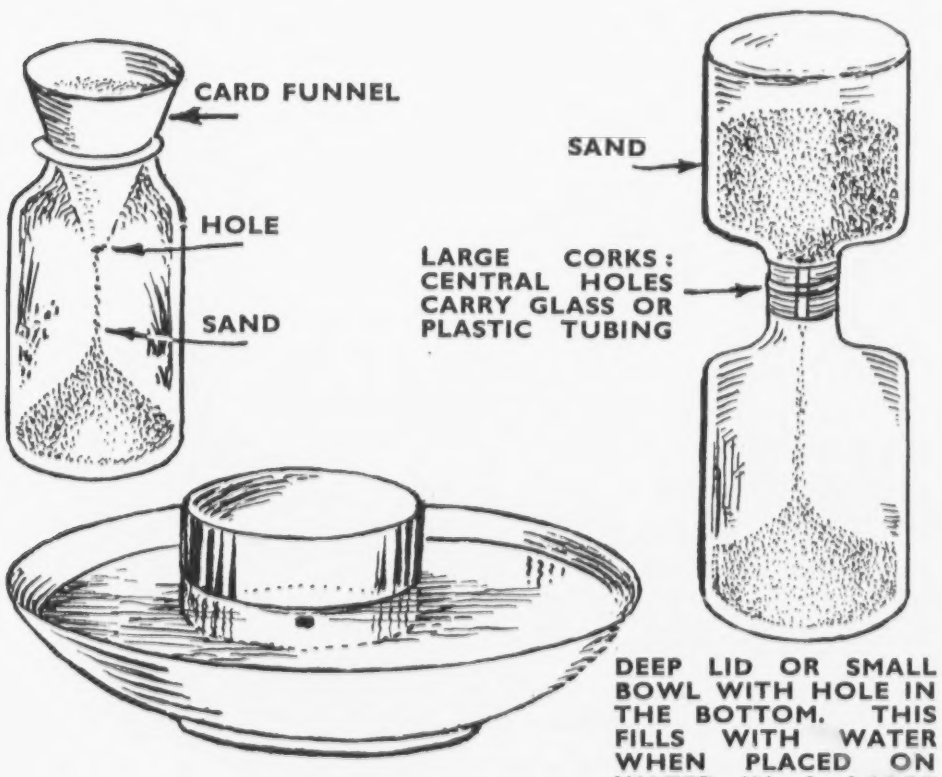
MATERIALS AND EQUIPMENT

Timing Devices

This equipment should be made so that only short lengths of time, say up to two minutes, are measured.

The purpose of this equipment is to **indicate a period of time.** It should not be used in Section C to compare lengths of time against a clock. It is merely to denote when an activity is to commence and when it is to stop, and to eliminate the necessity for reference to the clock.

The equipment can be adapted to measure longer periods in later sections of the course.


CARD FUNNEL
HOLE
SAND
SAND
LARGE CORKS : CENTRAL HOLES CARRY GLASS OR PLASTIC TUBING
DEEP LID OR SMALL BOWL WITH HOLE IN THE BOTTOM. THIS FILLS WITH WATER WHEN PLACED ON WATER IN A LARGE BOWL.

SUGGESTED ACTIVITIES

Refer also to the notes in the suggested activities for length, Section C, page 76.

Provide real clocks or cardboard clock-faces with movable hands, and a set of flash-cards.

Set the clock to show the hour nearest the time when you do these things :

I wake up.	I eat lunch.
I come into school.	I go to bed.

★

Provide a set of flash-cards for the days of the week except Sunday and a card prepared as shown, also some counters.

Put the names of the days in order in the spaces on the card.

Then put a counter beside the days when you come to school.

SUNDAY

★

From this list copy the things you think it would take less than an hour to do :

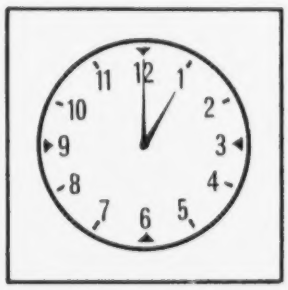
Hop five times.
Go to London.
Paint the house.
Walk home from school.
Comb your hair.
Eat your lunch.
Knit a dress for the big doll.
Run from the shelter-shed to the incinerator.

★

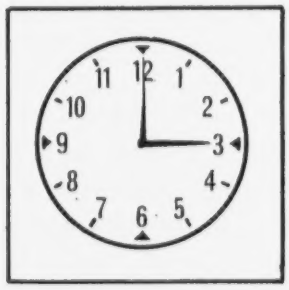
Provide cards showing marked clock-faces and cards naming different times.

Match the clock-faces with the times like this :

one o'clock



three o'clock



★

Provide an egg-timer or some other means of indicating equal intervals of time. Do not use a clock.

Fill the gaps in these sentences: :

While the sand runs through I can thread ◯ beads.

While the sand runs through I can write ◯ words.

While the sand runs through I can cut ◯ shapes.

★

Provide clock-faces stamped on paper.

Mark in any hour you wish on the first clock.

Show one hour later on the next clock.

Mark each clock after that to show one hour later than the clock before.

What time does the last clock show ?

★

Provide the children with a clock-face with movable hands or clock-faces stamped on paper. The children work in pairs.

Child A asks Child B : "Show (or mark on the clock-face) the hour between 5 o'clock and 7 o'clock."

If this is done successfully, Child B sets the problem : "Show (or mark in) one hour before 2 o'clock."

The game continues with the children taking turns to set the problems.

SECTION C—MONEY

NOTES

In Sections A and B, the child learnt to " buy " and to " sell " and to recognize coins up to ten cents. His transactions have been limited to tendering money, without change being involved, for one article.

In Section C the range of buying and selling is extended to more than one article, with the limitations that—

(i) change should not be required ;

(ii) the maximum amount involved should be ten cents.

Examples of transactions within these limits are :

A child buys a book at seven cents :

(i) No change is to be involved, hence the child must tender seven one-cent coins ; or three two-cent coins and one one-cent coin ; or any combination of coins totalling seven cents ;

(ii) the transaction involves less than ten cents ;

(iii) should the child wish to buy something more, this becomes a second transaction.

A child buys two articles, one at five cents and one at four cents :

(i) The purchase probably lies within the limit of his number experience, that is, $5 + 4 = 9$;

(ii) no change is to be involved, hence he must tender nine one-cent coins, or one five-cent coin and two two-cent coins, or any combination of coins totalling nine cents.

Thus, as the child's number experience extends, he is able to use this experience in his money activities, which can provide—

(i) a link with his pure number knowledge ;

(ii) an opportunity to apply this knowledge at his own level of understanding ;

(iii) situations where he can gain further experience in discussing relationships :

For example, in the transaction above, that

$4 + 5 = 9$,

$5 + 2 + 2 = 9$,

and all the other possible combinations ; and all this is achieved informally.

It is also important for the teacher to be aware of further opportunities to discuss money and its use outside the limits of shopping, such as with bus fares, banking, admission charges, and the like. The child's experiences will have probably increased as he has been given more responsibility in the home, and he may have used money in the canteen, in the school bus, in shopping for himself, and in other ways.

This could all be reflected in the child's ability to recognize coins which, in Section C, is extended to include recognition of the twenty-cent coin.

The equivalent values of coins will become an integral part of shopping activities, and this may be reinforced by activities suggested later. It is sufficient for the child to be able to show the value relation between two coins :

One two-cent coin has the same value as two one-cent coins ;

five one-cent coins have the same value as one five-cent coin.

Outcomes

By the end of Section C the child should—

(*a*) be able to shop within the limit of ten cents, no change being involved ;

(*b*) recognize coins to twenty cents ;

(*c*) use money within the limits of his number knowledge ;

(*d*) know the equivalent values of coins.

SUGGESTED ACTIVITIES

Refer also to the notes on the suggested activities for length, Section C, page 76.

Provide a set of coins of various denominations.

Find as many coins as you can which together are worth less than 20 cents and more than 5 cents.

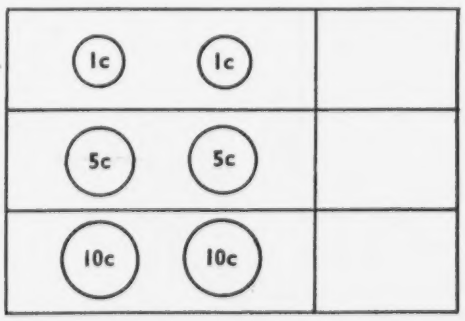
★

Find all the coins you can which are different.

Put them in order from the one of most value to the one of least value.

★

Find one coin to match each of these sets of coins :



Now fill the gaps in the sentences below with the words

" worth more than "

" worth less than "

or " worth the same as ".

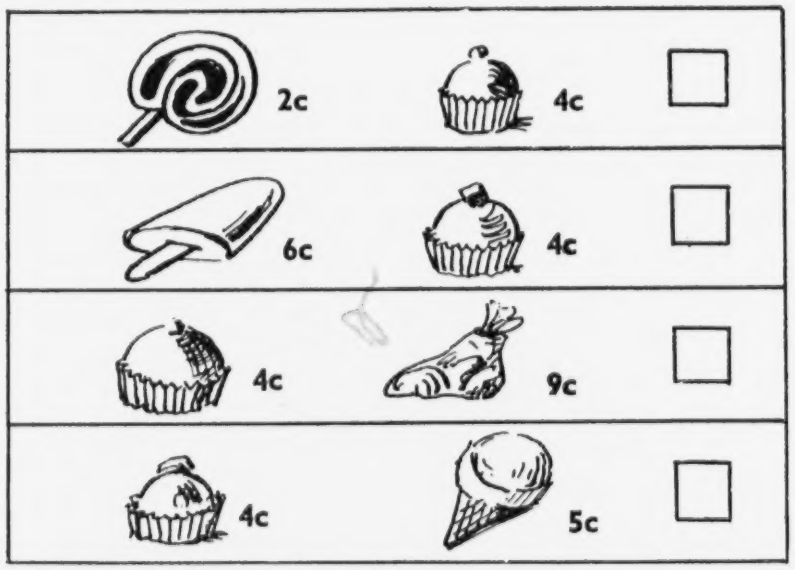
Two 1-cent coins are ☐ one 2-cent coin.

Two 10-cent coins are ☐ one 20-cent coin.

Two 5-cent coins are ☐ one 10-cent coin.

★

You have ten cents to spend. Put a cross beside the pairs of things you could buy :



Now write beside each pair that you can buy how much that pair would cost you.

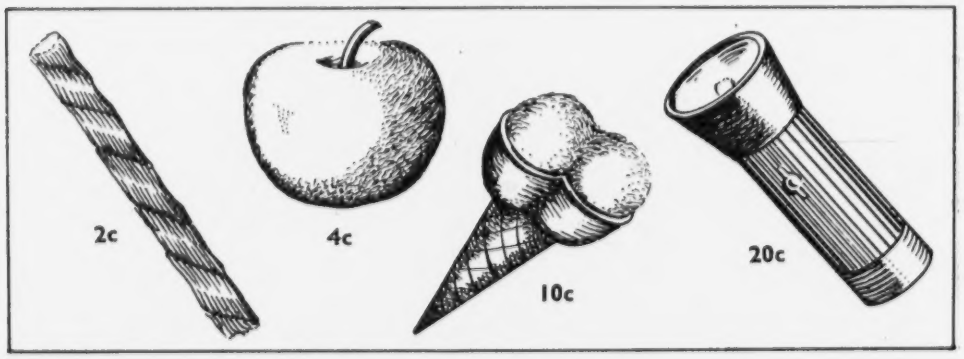
★

Provide a card upon which bus or tram tickets of different values are pasted.

Match coins to the tickets so that you would be paying the conductor the exact fare.

★

Find two coins you could put together to pay for each of these things :



★

You have ten cents to spend at the shop. Buy as many things as you can with this money.

How many things did you buy ?

Draw each one and write the price you paid for it beside your drawing.

SECTION C—SPATIAL RELATIONS

NOTES

In Section C, the work of the earlier sections is continued by encouraging the child to become more aware of his environment, thus making him more conscious of shapes. It will be evident from the notes that follow that much of the work will be informal, in many instances based upon incidental discussion with the child, a group, or the whole class.

Environment

The child has been concerned with the classroom environment, finding materials and describing location. He has developed the ability to move from one part of the school-ground to another of his choice with a minimum of effort. He knows the boundaries of the sections of the school-ground without these being marked or fenced off.

In Section C this knowledge becomes more definite. Not only does he develop the ability to describe routes from one position to another, but he is able to describe alternative routes.

He will extend the area to be explored to include the immediate school surroundings and his route to and from school. He should develop the ability to describe the route he takes to school and be able to name familiar streets, roads, and landmarks.

Within the classroom he should be able to describe the location of materials with precision :

> "The ball is in the big box on the second shelf of the cupboard near the door."

Shapes

The focusing of the child's attention upon shapes serves two major purposes. Primarily, it allows recognition of certain shapes, such as the circle and the triangle, which will become basic to geometry later in his school-life. Any description of these shapes should be couched in everyday vocabulary, and no effort should be made to formalize this or formulate a definition.

Concurrent with this is the widening of recognition so that the child may see these shapes in objects that surround him in his environment :

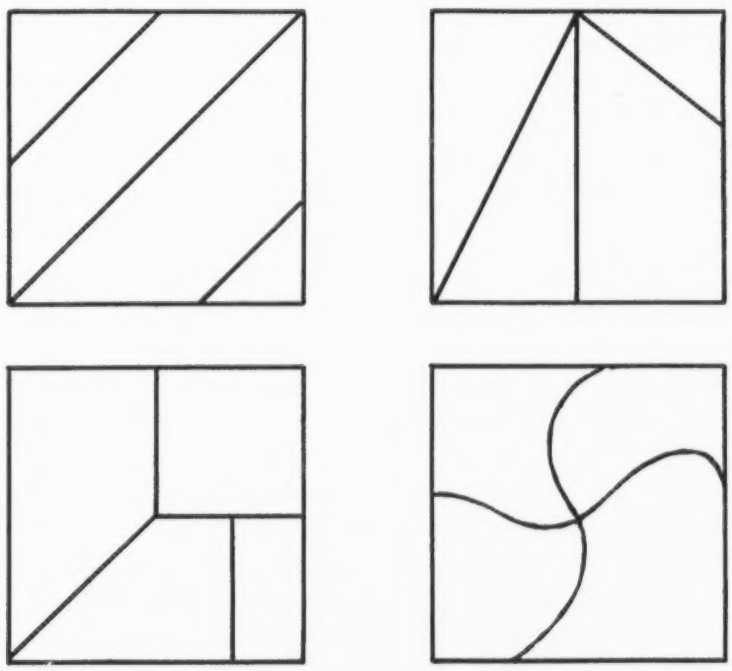
> Previously the child would have recognized a circle as such, and would also have seen this shape in the tyres of the car, the wheels of his bicycle, the plate that he uses, and so on.
>
> In Section C the child comes to recognize things which are not quite true geometrical shapes. He realizes that a face is not a true circle, and yet he can use this shape in his drawing symbols and be satisfied. He is able to generalize more with respect to similarities in shapes.
>
> In earlier sections the child could recognize shapes which were isolated, such as the triangular shape of the sandwiches he ate for lunch.

In Section C, the child's ability to select shapes grows and he can see triangular shapes, for instance, when they are surrounded by other shapes, such as those made by struts, supports, and scaffolding.

Shadows and clouds can play an important part in this work and the child should be continually encouraged to look at them and discuss the shapes he sees. The child is also, in these activities, encouraged to move away from severely geometric shapes and use his imagination.

Much of the child's activity work should be concerned with cutting shapes from paper, card, and material such as rolled clay or dough. He should be given the opportunity to join these shapes together to make new shapes. These can then be related in his mind to shapes in the world around him, or utilized as the basis for making patterns and designs.

Inset boards and jigsaw puzzles are valuable aids since they provide the opportunity for one shape to be broken into smaller ones which are then fitted together to synthesize the original. It is suggested that for jigsaws four pieces to be fitted together will provide a sufficient level of difficulty at this stage. Examples of patterns for these are :



Since use of the inset board defines the shape to be made, more than four pieces may be used. A greater degree of difficulty is experienced when the child is presented with the puzzle pieces and merely asked to make a particular shape, or even given the pieces without any guidance as to the shape and the size of the completed puzzle.

Sorting, arranging, matching, and comparing shapes should continue throughout this section. Teachers should continue to give the child opportunities to choose the attributes upon which grouping will depend :

All the shapes with straight sides ;

all the shapes with curved sides ;

the red, the yellow, and the blue shapes ;

all the shapes that fit inside the lid of the ice-cream can ; the shapes that are too big to do this.

Left and Right

Ideas of left and right should be strengthened in Section C so that the child will come to use these terms readily. The ideas of left and right often develop slowly and the teacher should use these terms freely.

Outcomes

By the end of Section C the child should—

(*a*) be able to relate some formal shapes to objects in his environment ;

(*b*) readily group shapes according to a selected attribute ;

(*c*) be able to describe his route to and from school ;

(*d*) create new shapes from those he can name ;

(*e*) fit shapes together in simple jigsaw puzzles ;

(*f*) have an increased awareness of left and right and be able to use these terms in his vocabulary.

SUGGESTED ACTIVITIES

Refer also to the notes on the suggested activities for length, Section C, page 76.

Provide a shape, such as a triangle, a square, or an oblong made of card or wood.

Trace around this shape as many times as you like, putting it in a different place each time.

Colour in any new shapes you have made.

★

Provide an ice-cream can lid and an assortment of shapes.

Put four square shapes inside the lid.

Put five circular shapes to the left of the lid.

Put one tall shape to the right of the lid.

How many things have you put out altogether ?

★

Look at the picture and then fill the gap in each sentence with the correct word from the list on the right.

The rabbit is to the ☐ of the tree.	LEFT
The bird is ☐ the possum.	RIGHT
The possum is to the ☐ of the tree.	ABOVE
The flowers are to the ☐ of the rabbit.	BELOW

★

Provide paper shapes, possibly made in a previous handwork lesson.

Make a pattern with these shapes. You may cut them if you wish.

★

Fill the gaps in the sentences below :

On the way home I pass ☐ butcher shops.

When I come to school I cross ☐ roads.

I go round ☐ corners when I go home from school.

I pass ☐ fruit shops on my way to school.

★

Provide a collection of buttons of different shapes and sizes.

Sort the buttons into groups :

Those shaped like circles ;

those shaped like ovals ;

those shaped like squares.

Order the buttons in each group.

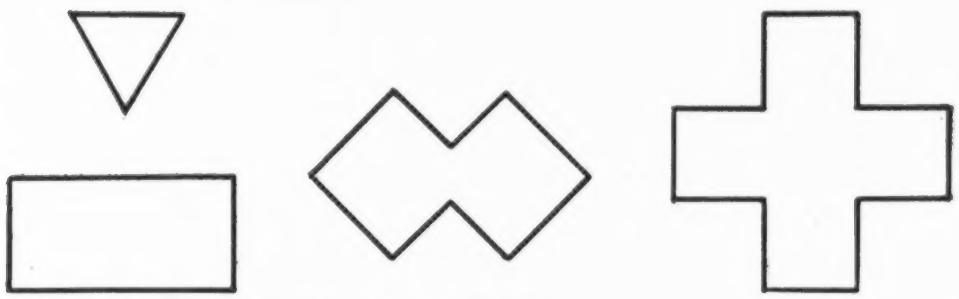
Of which button of a certain shape did you find the most ?

From the buttons that are not in any group can you make up a group and name it ?

★

Provide a geoboard and coloured rubber bands.

Look at these shapes and then try to make them on the geoboard.
Use a different colour for each shape.



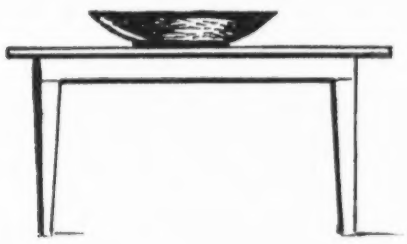
Can you make any other shapes ?

★

Copy the sentence that is true :

The dish is on the table.
The dish is under the table.

The flower is outside the ring.
The flower is inside the ring.



Now draw two pictures of your own and write a sentence about each one.

★

Provide squares of coloured paper.

Cut your piece of paper into sixteen squares.

Place the squares any way you wish so that you make new shapes.

Paste the new shapes onto paper.

★

Provide counters or other shapes.

Look at this pattern :

Do you see that it is the same when you look along it from left to right as from right to left ?

Make another pattern where this will happen.

★

Provide a picture postcard.

Cut your card into five oblong shapes.

Jumble them up.

Now make the shapes back into the picture.

★

Attribute blocks or similar material may be used for a number of activities :

Make a pattern using any two (three, four, etc.) blocks as a repeat.

★

Put these shapes together to make new shapes.

Can you name any of the new shapes ?

★

Put the blocks in order according to—

(*a*) size ;

(*b*) shape ;

(*c*) colour ;

(*d*) any combination of these.

★

Attribute blocks or similar material may be used for a number of games, the children working in pairs or in groups.

Game : "*I SPY*".

The first child describes a block from the set :

"I spy with my little eye a shape that is large, blue, round, and thin."

The other children attempt to find the block, and the successful child makes up the next description.

★

Children work in pairs. The first child selects a block, his partner selects another block in which only one attribute is changed :

Child A selects a thick, big, red block ;

Child B selects a *thin*, big, red block ;
or a thick, *small*, red block ;
or a thick, big, *green* block.

Only one block of each kind is put out at the beginning of the game.

★

The previous game may be extended as the children gain experience until they can change all but one attribute :

Child A selects a thick, big, blue, oblong shape ;

Child B selects a thick, *small*, *red*, *circular* shape ;
or a *thin*, big, *green*, *triangular* shape.

SECTIONS A–C

STATISTICS AND GRAPHS

NOTES

Note.—A full discussion of the development of this topic from Section A through to Section F will be found in the Curriculum Guide, Applied Number Course, Sections D, E, F, and it is suggested that all teachers refer to this.

The Course of Study in Mathematics does not list statistics and graphs as a topic of Section A, but there are important aspects which develop in this section through many activities of the classroom outside the field of mathematics.

Through these activities, and incidentally, the child comes to—

(i) recognize pictures as being representations of actual objects, places, events, etc. ;

(ii) appreciate pictures as being able to convey information ;

(iii) discover that pictures must be looked at and "read" or interpreted.

Comparison, an idea which was developed throughout the work of Section A, is utilized in Section B in the work on statistics and graphs.

When the child looks at a picture, he sees all the information presented at the one time. Interpretation of the picture involves looking at it, naming what is seen, and relating these names to one another.

Now the child discovers that the comparative element can be used. The plant which was "this tall" last week (A) has now become "this tall" (B). The mark denoting last week's height is still there, but the plant has changed.

The important knowledge to be gained from activities such as this is that the marks record information, the positions of the marks can be

compared, and that information can be extracted from the comparison of the positions.

Such knowledge does not come from isolated events, but is derived from many experiences in both pure and applied number. Incidental activities, using concrete objects as a means of comparison, may be extended ; for example :

> The boys stand in a line, the girls stand in a line in front of them. Which line is the longer ? Have we more boys or more girls in the class ?
>
> Place a button or a counter for each child in each of the rows. Do we have more red counters or more blue counters ? Who does this counter stand for ? Which is your counter, Mary ? Do we have more boys or more girls ?

A simple comparison is all that is required—that there are more boys than girls ; a quantitative assessment that " there are six more girls than boys " is a later development.

Teachers will discover opportunities for activities similar to the one outlined above, and further suggestions are listed in the Curriculum Guide, Applied Number Course, Sections D, E, F,

In Section C, the child is introduced to the idea that pictorial symbols may be used to represent information. The weather chart provides an example of this.

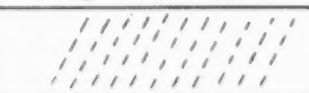
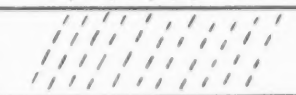
Aspects for the child to appreciate are :

(i) The " picture ", or symbol, conveys information ;

(ii) the chart provides a record—we can look at it and discover information :

" It rained on Wednesday and Thursday."

" It rained for two days."

MONDAY	
TUESDAY	
WEDNESDAY	
THURSDAY	
FRIDAY	

(iii) the chart can be used for comparison :

" We had more dull days than we had sunny days."

The activities of Section B will, of course, carry through to Section C, and by the end of this latter section the child should—

(*a*) realize that pictures convey information ;

(*b*) understand that symbols may be used to convey information, and that these may be—

(i) concrete objects, such as buttons, matchboxes, counters ;

(ii) pictorial, as used on the weather chart ;

(iii) marks, as used to denote the growth of the plant;

(*c*) know that comparisons can be made using these symbols.

VOCABULARY

(Sections A – F)

This vocabulary is intended as a check-list of words children should know and understand up to the end of Section F.

It is not prescriptive, nor is it necessarily complete. Much of the child's vocabulary comes from adults and older children in his environment, and this can cause variations from one area to the next. There are many places throughout Victoria where certain words are significant because of the locality or local industries :

"A stand of timber", "super feet", "four by two", are commonplace terms of the timber areas, are within the understanding of a young local child, and are important in his vocabulary.

To a city child, such words could be outside his vocabulary and understanding until after he has completed Section F.

It could be of advantage to the teacher to list these regional words as part of this vocabulary.

The words are listed in alphabetical order, and it is suggested that teachers may find it more useful to select the words appropriate to the section they are using and re-list them according to topic or in order of difficulty so that they may be readily referred to and perhaps used more effectively.

It will be noted that while such words as cent, inch, ounce, and gallon can be listed as referring to specific topics of the course, many other words are used with reference to more than one topic and hence are difficult to place in categories.

A further suggestion is made, that teachers, having selected and used certain of the words herein listed, should note them for the information of the teacher in the next grade.

Because some words vary in meaning according to the context in which they are used, it is important that teachers should use such words appropriately to allow the children to appreciate the different meanings :

For example—

one *foot* long ;
at the *foot* of the stairs ;
his right *foot*.

No degrees of comparison (big, bigger, biggest) are listed.

Brackets, ( ), indicate that words may be added to complete an expression, as in "a little ( )"—

a little *more* ;
a little *less* ;
a little *taller* ; etc.

about
about the same
above
across
add
afford
after
afternoon
again
age
alike
a little ( )
all
all day
all of it
almost ( )
along
altogether
amount
angle
ankle
another
answer
apart
arch
arm
around
arrange
as ( ) as
autumn

back
back to back
backwards
balance
ball
bar graph
before
begin
beginning
behind
below
beneath
beside
between
big
big enough
birthday
bit
bit longer
block
blunt
border
both
bottom
boundary
box
broad
build
buy
buyer

calendar
carry
cash
cash register
cent
centre
change
cheap
check
choose
circle
circular
clock
close
coin
cold
column
combine
compare
conductor
cone
contain
cool
corner
correct
cost
count
crooked
cube
cup

cupful
curved
customer
cylinder

date
dawn
day
days (names)
dear
deep
depth
diagram
dial
diamond
difference
different
difficult
disc
distance
divide
docket
dollar
double
down
draw
dusk

each
ear
early
earn
edge
empty
end
end to end
enough
( ) enough
enough ( )
equal
equals
estimate
even
evening
exact
expensive
eye

face
face to face
far
fare
fast
feels
feet
few
fill
find
finger
finish
first
fit
flat
foot
forward
fraction
from
from ( ) to ( )
front
full

gallon
gap
glass
glassful
go
graph
great
group
guess

half
half full
half-hour
half-pint
hand
handful
hard
head
heavy
height
here
high
horizontal
hot
hour
huge
hurry

in
in a little while
in from
inch
inches
inside
into

jar
jarful
join
just right

kite-shaped
knee
knot

large
last
last ( )
late
later
least
left
leg
length
less
level
light
lighter than
like
line
liquid
little
little ( )
long
long time
looks
lot
low
lunch-time

many
match
measure
midday
middle
middle-sized
midnight
mile
minute
model
money
month
months (names)
more
more than
morning
most
mouth
move
much ( )

narrow
near
nearly ( )
next
next to
night
none
noon
nose
not ( )
notes
now

oblique
oblong
o'clock
odd
once
on top of
opposite
order
ounce
out
outside
oval
over

pace
pail
pair
part
pattern
pay
pictograph
piece
pint
playtime
point
pointed
pound
pour
price
pull
push
put in order
put together

quantity
quart
quarter
quick
quickly

ready
record
rectangle
rectangular
remove
right
rough
round
row
rule
ruler

same
same as
save
season
seasons (names)
second
sell
seller
set
several
shallow
shape
share
sharp
shop
shopping
short
short time
side
side by side
sideways
size
slant
slope
slow
slowly
small
smooth
so ( )
soft
sold
solid
some
some of it
soon
sort
sour
space
span
spend
sphere
spill
spoon
spoonful
spring
square
star
start
step
stop
straight
stride
strip
subtract
surface
sweet
swift

table
tablespoon
tablespoonful
take away
tall
teaspoon
teaspoonful
tell
there
thick
thin
third
tie
time
time to
tinful
tiny
today
together
tomorrow
too ( )
top
tower
triangle
triangular
turn
twice
twilight
under
underneath
uneven
unequal
unit
up
upside down

value
vertical
vary

wait
warm
watch
way
wedge
week
weigh
weight
when
whole
wide
width
winter
worth

yard
year
yesterday

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